SCIENTIFIC AMERICAN

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THE NEW WAR SHIPS TEXAS AND OREGON.

In the present issue we publish illustrations of new United States battle ships Texas and Oregon, which have been for some time in course of construction, and are now at last nearing completion. Both vessels will make important additions to our navy, and of their kind both are considered model ships. The Oregon is known technically as an armored coast line battle ship of the first class, and is being built by the Union Iron Works, of San Francisco, Cal. The Texas is being built by the government at the Norfolk Navy Yard, and has been designed to carry guns of the heaviest caliber, and to be protected by an armor which will resist the projectiles of similar guns on an enemy's vessels.

The Oregon, which has been built on the Pacific coast by the Union Iron Works, of San Francisco, Cal., was launched on October 26, 1893. The appropriation to provide for building the Oregon was $4,000,000. It is a sister ship to the Indiana and Massachusetts. The Oregon will be one of the largest and most important vessels of our navy, and is considered in all respects a model ship. The length of the Oregon is 348 feet, the beam 69¼ feet, draught 24 feet, displacement 10,200 tons, and maximum speed 16·2 knots per hour. The coal capacity is 1,800 tons. At full speed the Oregon will be able to run 5,000 miles without replenishing the coal supply, or at a speed of 10 knots it may run 16,000 miles. It is protected by a belt of armor 7½ feet wide, which extends 3 feet above the water line and 4 feet below it. This armor is 18 inches thick, and over this is a steel protective deck 3 inches thick. At each end of the armor belt are redoubts 17 inches thick which provide an armored freeboard of 15 feet 2 inches. The turrets revolve in these redoubts. There are also heavy protective decks forward and aft of the belt, and in these the coal is stowed to provide additional protection. The steel conning tower is 10 inches thick, and is well provided with the necessary complement of signals, speaking tubes, etc. The engines of the Oregon are of the twin screw, vertical triple expansion, direct acting, inverted cylinder type. The stroke is 42 inches and the diameter of the cylinders 34½, 48, and 75 inches respectively. The battery consists of four 13 inch breech-loading rifles, eight 8 inch breech-loading rifles, four 6 inch, twenty 6 pounder rapid-fire guns, two Gatlings and 6 torpedo tubes. The 13 inch guns are 18 feet above the water, and can be moved through an arc of 270 degrees, and it is believed that this battery would annihilate any small vessel which came within range.

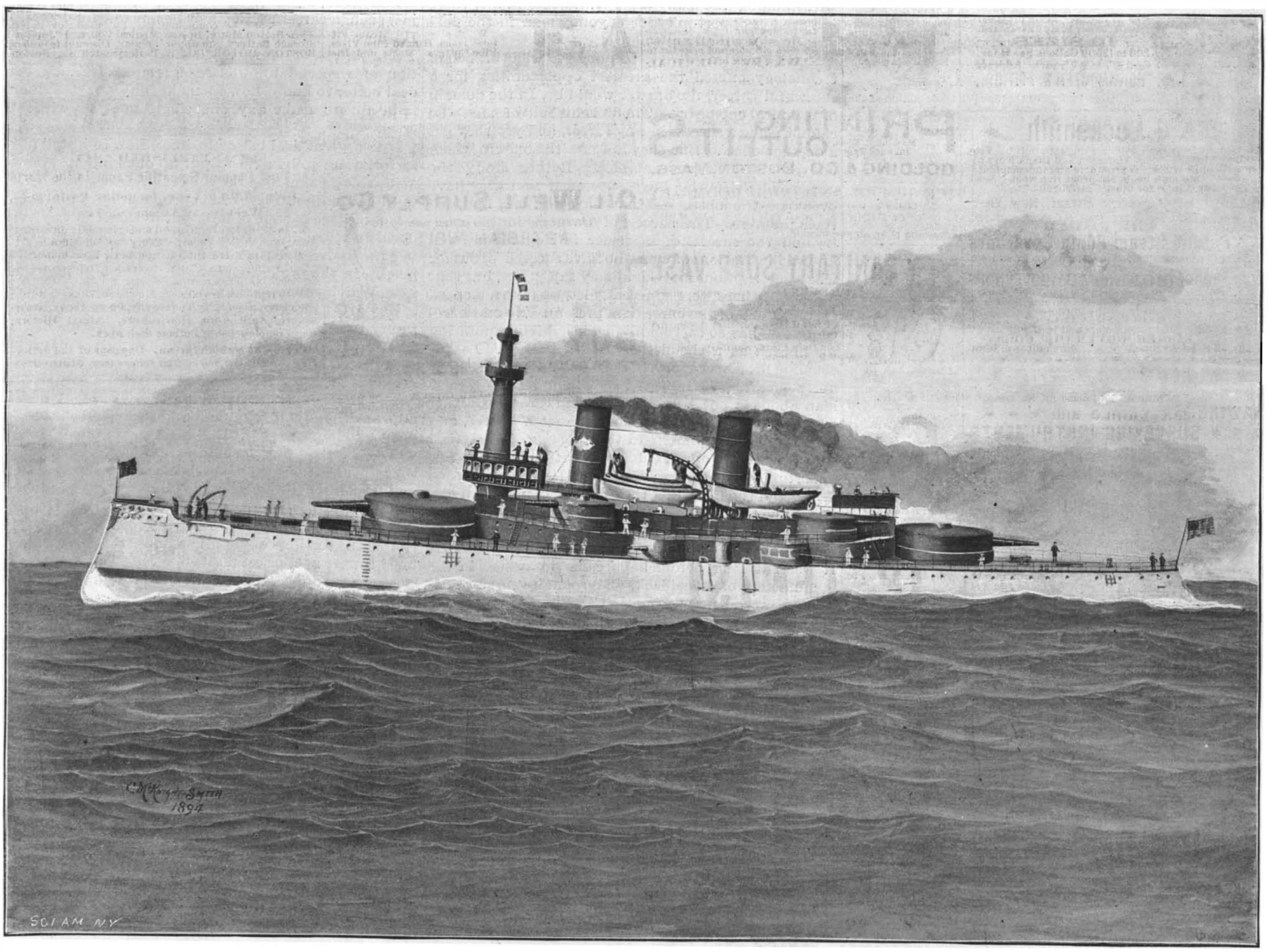
The Texas was launched on June 28, 1892. The original plans were made by English designers, but these have since been considerably altered, so that the ship has been built for the most part from American designs. The Texas is a twin screw, steel armored vessel of 6,335 tons normal displacement. She will be driven by two sets of triple expansion engines capable of developing 5,800 horse power with natural draught and 8,600 horse power with forced draught. The vessel will be 290 feet in length and 64 feet 1 inch wide. It will have a mean draught of 22 feet 6 inches and will carry about 950 tons of coal. The main armament will consist of two 12 inch breech-loading guns, each weighing 46½ tons, mounted in two turrets, one on either side of the forward deck. A secondary battery will consist of four 6 pounder and four 3 pounder rapid-firing guns, with four 47 mm. Hotchkiss guns. All of these will be mounted on the gun deck with a 1½ inch plating to protect them. There will be besides two Gatling guns and two 37 mm. Hotchkiss guns mounted on the bridge. The military tops and the flying bridge will be provided with similar equipments.

The turrets will be armored with 12 inches of steel and their bases will be inclosed by a diagonal redoubt armored with 12-inch steel plates, which will also serve to protect the hydraulic machinery used for operating the guns and the smoke pipe casings. The boilers and engines will be protected by a belt of armor 12 inches thick, extending 2 feet above the designed water line and 4½ feet below it, having a length of 116 feet. There will be a protective deck built of 12 inch steel above the armor belt. The hull of the Texas is built on the cellular system and is constructed throughout of steel. A double bottom extends under the engines, boilers and magazines and is divided into numerous watertight compartments by longitudinal and transverse partitions. There are in all 129 of these compartments, and all are connected to steam and hand pumps by an extensive drainage system.

It will be seen, therefore, that in the case of accident from rams or torpedoes, it will be practically impossible for the Texas to be sunk. The boilers and engines will be placed in watertight compartments.

The ship will be lighted throughout with electricity

(Continued on page 40.)



THE OREGON, UNITED STATES BATTLE SHIP OF THE FIRST CLASS—10,231 TONS DISPLACEMENT.

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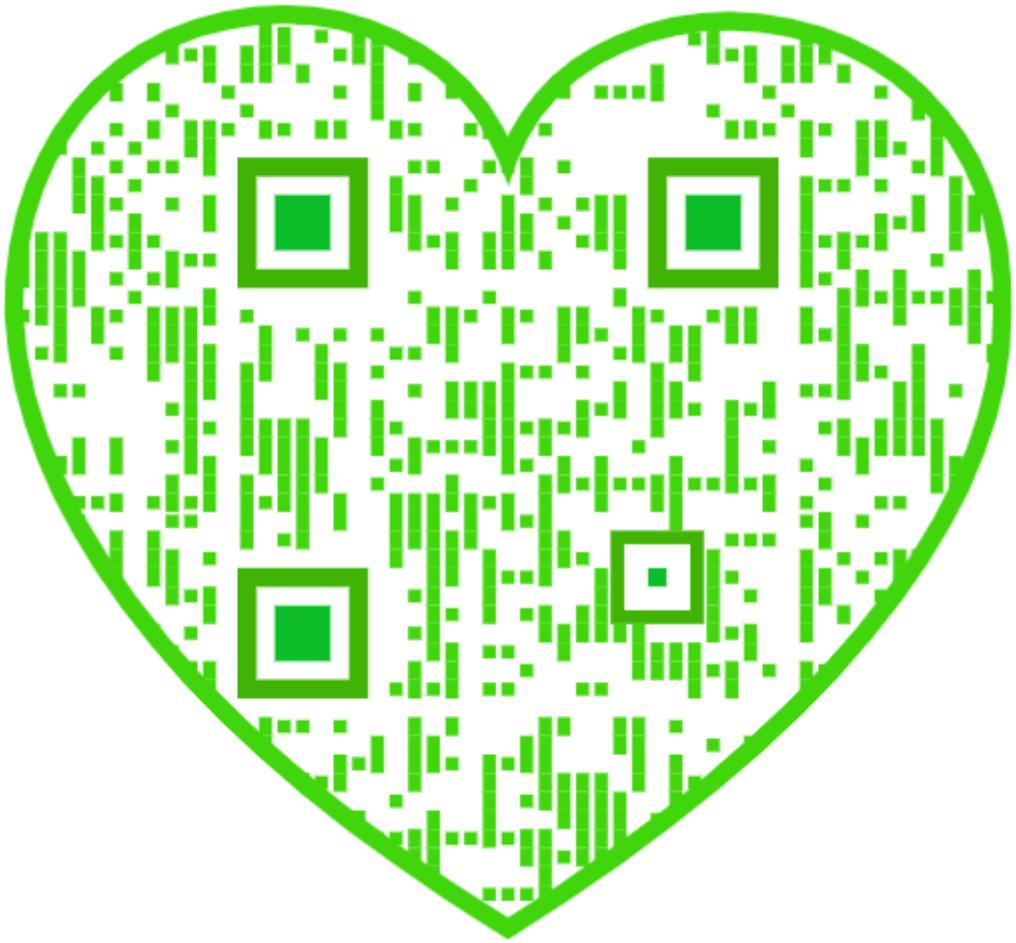

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Contents.

(Illustrated articles are marked with an asterisk.)

Army, needed increase of the.... 40
Battery, a compact Capo-Farad*. 43
Birds and their persecutors..... 39
Boiler explosions..... 35
Boilers injured by grease..... 37
Books and publications, new..... 44
Capitol, Albany, great staircase in 35
Career, choice of a..... 34
Cars, parlor, pneumatic berths and cushions for*..... 43
Diastase, preparing..... 43
Drowning, what it feels like..... 35
Earth currents, electrical (6350).. 45
Earthquake waves..... 34
Earth, the, internal heat of (6356) 45
Hawk, the Cooper's..... 43
Horseshoe iron industry, the*.... 41
Illustrations of magazines and papers, how made..... 35
Inventions recently patented..... 44
Irrigation, progress of..... 38
Lead poisoning in dyeing..... 36
Locomotive cab storm window... 43
Locomotive fireman, the..... 40
Meteorite, the Plymouth..... 35
Notes and Queries..... 45
Orange crop, injury to the..... 39
Oregon, battle ship, U. S.*..... 33
Ore mill, Beer's*..... 36
Ostrich farm, work on the..... 43
Parks and park planting..... 42
Patents granted, weekly record... 45
Photograph, punch..... 36
Pneumatic car, berths and cushions*..... 43
Railway grade crossings..... 36
Ship canal to the Lakes, the..... 42
Snows of Mars, the..... 39
Sponge industry, Florida, the 38
Sugar cane cultivator, Danos and Haydel's*..... 36
Superphosphates, phosphoric acid
Texas, battle ship, U. S.*..... 42
Trade marks, German..... 34
Typewriter, telegraph, the*..... 37
Watches, curious*..... 37
Windmill pump gear, Erickson's*. 36

TABLE OF CONTENTS OF

SCIENTIFIC AMERICAN SUPPLEMENT

No. 994.

For the Week Ending January 19, 1895.

Price 10 cents. For sale by all newsdealers.

PAGE

I. AGRICULTURE.—Spraying for Black Knot upon Cherries and Plums.—Details of experiments tried at the Massachusetts State Agricultural Station..... 15882

II. CHEMISTRY.—The Rise of Organic Chemistry.—By V. CORNISH, M.Sc., F.C.S..... 15893
Chromium Fluoride in Wool Dyeing..... 15894

III. ENGINEERING.—Engineering Fallacies.—An address to the graduating class of the Stevens Institute of Technology by President HENRY MORTON.—This paper contains some interesting details of perpetual motions, the Keely motor, etc.—2 illustrations.. 15888
Increasing Use of Traction Engines.—Description of traction engines used for logging purposes in California.—2 illustrations.. 15887
The Siphon of Clichy-Asnieres.—This siphon is 1520 feet long and belongs to the sewerage system of Paris.—4 illustrations..... 15886

IV. ENTOMOLOGY.—The Glowworm.—By E. A. BUTLER, B.A., B. Sc.—An interesting entomological study.—3 illustrations..... 15883

V. FISHERIES.—Oyster Culture on the West Coast of France.—Details of studies made in France.—By Prof. W. A. HERDMAN..... 15884

VI. FORESTRY.—The Battle of the Forests.—Lecture delivered by Prof. B. E. FERNOW of the Department of Agriculture before the American Association for the Advancement of Science.—A valuable resume of the conditions affecting the growth of our forests..... 15880
Leaf-like Timber Stains.—By JOHN T. CARRINGTON..... 15882

VII. METALLURGY.—Improved Ore Washing Machine.—Apparatus in use at the Monteponi zinc mines in Sardinia.—1 illustration.... 15890

VIII. MISCELLANEOUS.—Recent Science.—An important paper by P. KROPOTKIN, dealing with the new serum cure for diphtheria, giving details of the latest results in the laboratories of Paris and Berlin.—Earthquakes.—A study of the recent earthquakes which have visited Europe and Japan.—Flying Machines.—A review of the progress made from the time of Leonardo da Vinci to the present day..... 15890

IX. TECHNOLOGY.—Galvanizing.—By M. P. WOOD.—A valuable paper on various methods of coating metal with zinc, with special reference to the Cowper-Coles process 15885

X. TRAVEL AND EXPLORATION.—The Andes of Ecuador.—Views of Chimborazo, 20,702 feet high, and the great crater of Quilotoa.—2 illustrations..... 15879

STATISTICS CONCERNING GERMAN TRADE MARKS.

The German manufacturers are not as indifferent as are American manufacturers to the benefits to be derived from the protection afforded by the trade mark laws.

This new law went into effect on the first of October last and resulted in the most wonderful activity in this department of the Patent Office.

During the month of October, 1894, about 8,000 applications for the registration of trade marks were filed in the German Patent Office; 5,950 of these applications related to trade marks which had already been registered under the provisions of the trade mark law of November 30, 1874, the present law requiring all such trade marks to be registered, anew before October 1, 1898, to preserve their validity.

Such a result was entirely unexpected, and the Patent Office officials have their hands full in attending to the great mass of work which is piling up in the office.

ON THE CHOICE OF A CAREER.

There are times in a young man's life when he is beset as to what he shall do for a livelihood, and the question as to a choice between a profession and a technical course is before him. In looking over an experience of nearly fifteen years, it seems as if, notwithstanding the many disappointments in life, there is a greater opportunity for a young man in the field of technology than anywhere else.

If the question were to be put as to what branch of technology offered the greatest opportunities for a successful career, the answer would be, In the domain of technical chemistry. The world is full of men who cannot make a success in any career, and yet they get along somehow. But they are not the ones to whom one should look as examples. Rather study the careers of those who have succeeded and who have overcome the obstacles that have at times impeded their progress. The success of Carnegie in this country and the success of Bessemer in England are well known illustrations of men who have succeeded, but for fear some captious individual may say, "Yes, but that was when times were different," let us take a modern example, one of the immediate present. No one in recent years has so thoroughly made a high reputation for himself as a chemist as H. Y. Castner. Let us examine his career for a short while, and see if there is not something in it that may encourage the young man about to enter upon a technical career. Castner left the School of Mines in 1879 without a degree, and at once devoted himself to the practice of analytical chemistry. An analyst has, unfortunately, but few opportunities of developing his abilities. He does one thing, and the one thing that dozens of men can do, and do equally well. There is no future to that sort of work. This Castner promptly recognized and devoted his leisure to the study of chemical processes. It was not long before he became interested in the manufacture of boneblack, and soon invented a continuous process for making that article. It was a chemical success, but, for reasons that had to do with the economic conditions of the market, it failed to be a pecuniary success. The cheap production of aluminum was then a subject of considerable study on the part of chemists both here and in Europe. Castner examined the ground very carefully, making a very complete study of the literature of the subject, and then set to work experimenting. He soon invented a process concerning which Sir Frederick A. Nobel, in his presidential address before the British Association in 1890, said that it constituted "one of the most interesting of recent illustrations of the progress made in technical chemistry, consequent upon the happy blending of chemical with mechanical science through the labors of the chemical engineer." A unique success was made, and the world heralded the new discovery with applause, but soon electrolytic processes compelled the abandonment of the direct chemical production of aluminum.

The characteristic feature of the Castner process was its method of making sodium, and he promptly turned his attention to that element, creating a demand for it which he supplied. He also called attention to the value of sodium peroxide, which was promptly recognized, and his plant at Oldbury continued in active operation, furnishing at a profit many of the sodium salts. Here we have a career of a chemist who is not yet forty years of age, but who has invented three valuable improvements in existing processes. These inventions, each of which has marked a distinct era in the progress of science, have gained for the inventor a handsome fortune.

More recently Castner has invented an electrolytic process for the decomposition of alkaline chlorides, yielding caustic soda and chlorine, which, according to certain English technical journals, may result in revolutionizing the long accepted Le Blanc and Solvay processes.

It is not necessary to enter upon any discussion of the merit of these inventions. They are cited simply for the purpose of illustrating that opportunities exist around us all the time, which, if promptly seized upon, lead to fortune and reputation.

In no country in the world are the possibilities of a successful career in the line of technical chemistry more evident than in these United States. With the single exception of potassium salts, there is no limit almost to the amount of crude substances existing in nature, capable and ready for use. One single illustration of this fact may be permitted. Candles made from the paraffine contained in ozokerite are considered superior to all others. If the deposits of this mineral that exist in Utah were developed and used for the making of candles, the entire supply required for the region that exists between the Mississippi River and the Pacific Ocean would be at the mercy of the maker. And yet we import candles.

The magnificent soap establishments in Chicago and Cincinnati are striking examples of the growth of enormous plants from very small beginnings. It is for such work that the chemist must educate himself. First he needs an education at some technical school, and there are many of these. In New York City there is the School of Mines of Columbia College; in Boston there is the Massachusetts Institute of Technology; in Chicago there is the Armour Institute; in Golden there is the Colorado School of Mines; and near San Francisco there are the technical departments of the University of California. In any one of these, and they are all good, a young man may prepare himself for just such a career as Castner has made for himself. He must devote himself to the study of principles. These will be of more value than skill in manipulation or a special knowledge of details. It is a great deal better to know how to make any analysis than to be able to make any one single analysis without error.

It is a great deal better to know how to install any factory than to be able to put up one kind of works. With this general idea the student pursues his course until graduation. Places do not come at once, and even sometimes are hard to obtain, but in time the way will open, and then, if the fledgling is able to put into practice the knowledge that he has acquired, there are no heights in the professional world to which he may not soar. Watch your opportunities. If you study the career of any great man, you will find that it was the opportunity that made him. Grant might have remained a tanner in Galena if his opportunity had not come to him with the civil war. If opportunities do not come readily, you must try and force them. No process is perfect so long as it is of human origin. Therefore, select a process, study it, find out its weak point, and endeavor to improve that. In this way your opportunity will come. Find uses for refuse materials. Remember that the refuse of gas works became the source of the aniline colors. Frequently the value of by-products is sufficient to pay for the process. Thus the precious metals obtained in the electrolytic refining of copper enable the smelters of Montana and Arizona to sell refined copper at a price far below that which English smelters can afford. Inspiration and suggestions frequently come from sources that are seldom expected. A poet was once speaking of his valuable reference library. The connection was at first blush not apparent, but it soon transpired that in his descriptions of nature he always verified his fancies by reference to his books. The reason of his having gained the reputation of being a poet true to nature was thus disclosed. His appreciation of a value or an application in something apparently remote from his work showed his genius. So it is in chemistry. The man who is successful will find suggestions when he least expects them, and which, if properly applied, will bring him wealth or that which is better, a high reputation.

Earthquake Waves.

Some of our readers may remember that the pulsations of the great earthquake in Greece last April were perceived in England and, it was believed, at the Cape of Good Hope, by means of very delicate instruments contrived for the purpose of registering any slight shaking of the earth's crust. In like manner the shock of the Constantinople earthquake of July last was perceived at various meteorological observatories in Austria, Russia, Germany, Holland, France and England.

By a comparison of times, combined with the distances from Constantinople of the places where pulsations were observed, a fairly accurate estimate of the velocity with which the earthquake waves traveled was obtained.

The average speed was about two miles per second. This is almost exactly the same velocity as that which was calculated for the pulsations of the Greek earthquake in April. At this rate, if it were continued without diminution, the wave would pass completely round the earth, along a great circle, in about three hours and a half.

One of the English instruments which registered these pulsations is at the bottom of a deep mine near Newcastle-on-Tyne, and its delicacy may be judged from the fact that it has recorded the beating of the waves on the sea coast ten miles away.

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How the Illustrations of the Magazines and Papers are Made.

In our issue of last December 1 we described the process of engraving for newspaper work. The following from the New York Recorder contains a more complete description of the processes used in illustrating our monthly magazines and newspapers, which to the general reader is but little understood.

Pictures for the illustration of magazines and some newspapers are now made direct from photographs. A glass screen with diamond scratched lines ruled at right angles so closely together that the spaces can hardly be distinguished is placed one-eighth of an inch in front of the sensitive plate in the photographic camera. Looked through, the effect is much the same as gazing through a sieve. These lines reappear in the half tone engraving when printed.

The photograph or wash drawing from which the photo-engraving is taken is photographed in the usual way and with the usual sensitive plate, with the previously described screen in the camera between the plate and the picture. This produces a negative of the picture, showing the fine cross lines represented by clear glass. Now, in order to have the same position of the object of the engraving as in the original, the film of the negative is treated to one or two coats of collodion, which gives it a sufficient consistency to permit of its being removed. The film is then stripped, reversed and secured to another glass with the aid of collodion. After careful mounting this new negative is ready to be used as a medium for printing on the zinc plate.

The face of the plate is buffed to the highest degree of polish, then coated with a solution of albumen and gelatin, then sensitized with bichromate of ammonia. It is then dried and placed in the printing frame, the coated side next to the negative film. The case is then exposed to the sun or light three to five minutes or to an electric light for fifteen to twenty minutes. The light passes through the heavy inch thick glass of the printing frame, then through the negative, striking the sensitized plate and decomposing the chemicals wherever it may fall. Where the plate is protected by the shadows and half tones of the negative the sun light has less effect, and where the shadows are dense it has no effect.

This plate is then removed from the frame in a dark room and carefully washed under running water for several minutes, then dried and heated until the picture appears of a dark brown color. The back of the plate is rubbed with wax while hot to protect it from the etching solution, which is made from perchloride of iron. The picture on the plate is acid proof, and the etching solution eats only where the plate is unprotected, that part which is blank in the finished engraving. The plate is allowed to remain in the acid bath for about fifteen minutes, or until sufficient depth is obtained. It is then washed and is ready for the router and the printer.

What Drowning Feels Like.

A woman, who was among those saved in the recent deplorable accident in Morecambe Bay, is reported in the papers to have said that she remembered sinking twice and thinking she had "only to go down once more and all would be over."

There are several authentic records of such experiences. One of the most interesting is that of Admiral Beaufort, as described by himself in a letter to Dr. Wollaston. When a youngster he fell overboard in Portsmouth Harbor, and before relief reached him had sunk below the surface. All hope had fled, all exertion ceased, and he felt that he was drowning. Two minutes did not elapse before he was hauled up, and he found the return to life much less pleasant than drowning. Admiral Beaufort adds that he had heard from two or three persons who had had a similar experience that their sensations had closely resembled his own. Sir Benjamin Brodie relates the case of a sailor who had been snatched from the waves and lain for some time on the deck of his ship insensible, who on his recovery declared that he had been in heaven, and complained of his restoration to life as a hardship.

In a well known passage of the "Confessions of an English Opium Eater," De Quincey relates that he was once told by a near relative that "having in her childhood (aged nine) fallen into a river, and being on the very verge of death but for the assistance which reached her at the last critical moment, she saw in a moment her whole life, clothed in its forgotten incidents, arrayed before her as in a mirror, not successively, but simultaneously, and she had a faculty developed as suddenly for comprehending the whole and every part."

An American gentleman, Mr. C. A. Hartley, has recently given an interesting account of his sensations when drowning. He lay at the bottom of a river in a state of semi-consciousness, in which he saw his relatives and friends all about him with their eyes full of tears. All the events of his life, from infancy upward, passed slowly before his mental vision; he felt that he was drowning, and he remembers thinking, unlike Clarence, that it was not pain to drown. He was able even to speculate whether his body would be found, and he pictured his own funeral, and fancied he could hear the earth thrown on his coffin. He had sensations of the nature of tinnitus (ringing of bells, etc.) in his ears, and he had visual perceptions of the most marvelous combinations of colors. Next all was peace around him; he had a peculiar feeling of well-being in a medium of a temperature neither too hot nor too cold. Then he felt himself as if raised from the earth, and floating in space, and looking down on the world spread out at his feet. Lastly came mere darkness and oblivion till he found himself stretched on the river bank and being subjected to the disagreeable process of restoration to life.

It will be noted that all these accounts agree in two points, namely, the apocalypse of the past life, even in its minute details, and the absence of any unpleasant sensation. On the whole, the popular idea (which in such matters is never wholly wrong) that drowning is a pleasant form of death is confirmed by the testimony of the few who have practically reached the bourne of the undiscovered country and yet returned to tell the tale.—British Medical Journal.

NOTE.—A friend of the writer, a reliable gentleman well known in business circles in this city, claims he died a pleasant death from drowning at the time of a steamboat disaster a few years ago.

His experience, as related about the time of its occurrence, was very like these given in this article. He claimed the act of dying, as he termed it, was a pleasurable sensation, while the resuscitation was distressing. —EDS.

The Plymouth Meteorite.

BY HENRY A. WARD.

The Plymouth meteorite was found in the year 1893 by Mr. John Jefferson Kyser, while plowing in a field on his farm, about five miles southwest of the town of Plymouth, Marshall County, Indiana. Mr. Kyser had, about the year 1872, found in the same field another, larger mass of the same iron. This mass was pear-shaped, about 4 feet in length by 3 feet in its widest diameter, narrowing to 6 or 8 inches at its upper end. It lay for a year or two so near the surface of the ground as to be seriously annoying in plowing the field. On that account Mr. Kyser, aided by his son, dug a deep hole by the side of the mass and buried it to the depth of 1½ to 2 feet beneath the surface, where it should thenceforth do no more damage.

The account of this I had last June from the son, Mr. John M. Kyser, now city clerk of Plymouth. Mr. Kyser well remembers the circumstance of the finding of the large piece and assisting his father in burying the same; and he further thought that, notwithstanding the removal of certain landmarks (a fence and tree) in the field, he would still be able to locate it very closely. This he subsequently undertook to do by trenching, but was unsuccessful in finding the mass. I was myself present and assisted in a further search for it in September last, using a surveyor's magnetic needle, with the hopes of the same being attracted to the mass and discovering it, but all to no purpose. Mr. Kyser seems to feel very confident of his knowledge of the immediate vicinity of the mass where he buried it 22 years ago, but is unable to prove its presence by rediscovery. Nor has he the aid of another eye-witness, his father having died soon after the original finding and burying as above mentioned.

The smaller piece, which was, as before said, found in 1883, was presented by Mr. Kyser, Sr., to Mr. W. S. Adams, who, at that time, kept a plow factory in the city of Plymouth. It was retained in their family until last November, when it was brought to Ward's Natural Science Establishment in Rochester, N. Y., by Mrs. Adams, from whom I procured it.

The mass is a lengthened, tongue-like form, not unlike a rude mound builder's ax. Its greatest length is 12½ inches, its width 7⅜ inches, its thickness in the middle about 2 inches, from which, in the greater part of its length, it slopes in a somewhat even manner to a thin, rounded edge.

Its surface is deeply eroded by oxidization, so that, although sound and free from scales, it shows no signs of an original crust. The characteristic pittings of meteorites are also by the same cause rendered somewhat feeble, although still quite clearly visible. We have cut a number of thin slices from the mass. These etched in dilute nitric acid give very clear Widmanstatten figures. There are, further, several small nodules of troilite.

A careful analysis of this iron has been very kindly made for me by Mr. J. M. Davison, of the Reynolds Laboratory of the University of Rochester, and I give the same below.

ANALYSIS OF PLYMOUTH METEORITE.

Fe	88·67
Ni	8·55
Co	0·66
Cu	0·24
P	1·25
Graphite	0·11
S	0·07
	99·55

This iron, herein briefly noticed, is interesting in many ways, and it is much to be regretted that the large mass, of which the record seems to me to be entirely reliable, cannot be rediscovered.—Amer. Jour.

Boiler Explosions.

At a recent meeting of the Engineers' Club, Philadelphia, Mr. John L. Gill, Jr., exhibited and explained a table showing the energy stored in boilers of different types, dimensions, and horse powers, and the height to which this energy could throw the boiler, with its weight of water, if allowed to act through an explosion.

The explosion which occurred recently at Shamokin, Pa., in a plant of 36 boilers, arranged in nests of 3, whereby 27 of the boilers exploded and were thrown to a considerable distance from their original resting places, was possibly due to gas having collected under one or two of the boilers, and by its explosion breaking the branch connection to the main pipe, thereby causing others to explode; or it may have been occasioned by one set of boilers running out of water, the latter cause being the more probable. Mr. Gill then explained, by means of the projecting lantern, a number of photographs which had been taken in the neighborhood on the day after the explosion. All of the boiler shells were broken circumferentially, and many of them had been thrown with such force that they had been embedded many feet in the side of a culm bank, some distance from the boiler house.

Mr. James Christie—As stated by Mr. Gill, the boilers at Shamokin were horizontal cylinders, about 44 feet long, and were suspended by rods 11 feet from each end. Hence they were not only subjected to internal pressure, but also to unequal strains at the top and bottom, due to this manner of mounting, and the latter strains must have been very great. In long boilers like these there is also unequal strain, due to the differences in temperature between the bottom and top, the latter in this case being open to the air.

Mr. Henrik V. Loss—When I was connected with the Edge Moor Iron Company I remember to have made some experiments whereby we found that the differences between top and bottom strains in some cases might be as much as 5,800 pounds per square inch.

Mr. John Overn—I examined the boilers at Shamokin on the day after the explosion and there was not a single case which showed any longitudinal strain. Each boiler shell was composed of 13 plates, and all but one of those which exploded broke in the section to which the suspension rods were attached. By the use of a blower the heat under the boiler cylinders was made very great, while the top of the boilers was cool. After inspecting boilers for many years, I have noticed that there are comparatively few exploded because of low water. The disturbance at Shamokin, I think, was due to unequal elongation on opposite sides of the boiler shells, and to the very poor quality of iron used in their construction.

The Great Staircase in the Capitol Building, Albany, N. Y.

During the past year the imposing stone staircase at the west entrance of the Capitol building at Albany, N. Y., has been practically completed, and as it now stands the stairway is one of the most beautiful constructions of its kind in the world. The entire cost of construction has been nearly $1,000,000, and about five and a half years have been consumed in building it. The staircase occupies a space of 76 feet 10 inches by 69 feet 10 inches, and the height from the tile floor of the first story to the uppermost cornice in the dome is 119 feet.

The stairway consists of broad central rows of steps, starting in the corridors and extending through the center openings between the cylindrical piers. The lower steps of each flight are constructed in convex curves, which serves to increase the length of the steps and makes it possible to introduce a platform or break in the steps about one-third the way up each flight. These platforms in turn are flanked by short rows of stairs on two sides, which extend at right angles to the main or central flights. These secondary flights extend to platforms which reach to the walls, and from these platforms next the walls four rows of steps, two from each platform, extend upward to the next floor, which also forms the landing of the central flight.

It will be seen that this construction provides for four wells, and these help to provide a plentiful supply of light and air to the lower floors. The central portion of the stairs is supported by eight bearings resting upon moulded granite bases, and extending up from the foundations to a height of three and a half stories.

The decorations of the staircase are very elaborate. On the central ledge on the north side, for example, there is a head of Columbus carved in relief, with the three caravels used by him in the first voyage to America. The western ledge is decorated with the Viking ship, while on the east ledge is a modern steamship, both of these being in bass relief. The sculptured work is cut upon a plain surface surrounded by rich foliage. The rails, the steps, the ledges upon which the balustrades rest, and in short almost every exposed surface is also richly and tastefully decorated.

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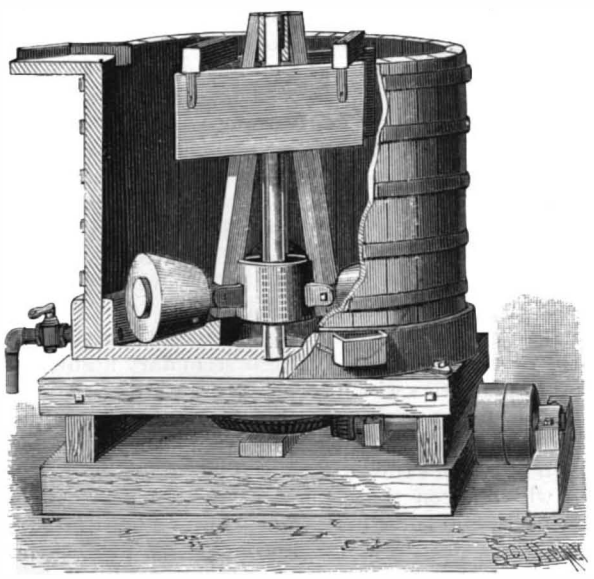
Lead Poisoning in the English Dyeing Trade.

Mr. Sydney Smelt, deputy coroner for Manchester, held an inquiry recently relative to the death of Emily Wood, 19, lately living in Irlam Street, Newton Heath, who had died from the effects of lead poisoning. The girl was in the service of Messrs. Kerr & Hoegger, dyers, Grimshaw Lane. Early in November she became ill, and was attended by Dr. A. Walker. He found well marked symptoms of lead poisoning. Dr. Walker said he had seen a number of cases of lead poisoning in the district of Newton Heath during the last few years. He gave evidence three years ago in the case of two girls working for the same firm who had died from lead poisoning. A girl named Carmichael, employed in the same room with the deceased, said that she had never used a respirator, and up to a week ago had never seen one in the place. The work was what is known as "noddling" yarn dyed in yellow and orange colors. Witness herself had been ill on several occasions from lead poisoning. Prior to a week ago the employes used to take their meals in the "noddling room. There was a place to wash their hands, but no towel was provided. Dr. Reynolds, who had made an examination of the body of the deceased, said the cause of death was lead poisoning. The manager of the works, while admitting that at a previous inquiry he had promised to see that washing accommodation and respirators were provided, said he had never seen more than two or three girls wearing the respirators up to quite recently. He only knew of three girls out of thirty-six who had never been away ill from lead poisoning, and he had never stopped the girls from taking their meals in the "noddling" room until recently. The occupation was a dangerous one, and he would not let his own daughter work at the place unless she wore a respirator. At the conclusion of the evidence the coroner suggested to the jury that they should recommend that this particular trade should be declared a special dangerous occupation under the Factory and Workshops Act. Mr. Smelt commented strongly on the conduct of the firm in not taking every precaution to prevent such cases, in accordance with a promise made on their behalf in the course of a similar inquiry in 1891. Nothing he could say could add to the feeling of indignation that everybody must have on this subject. The girls had simply been allowed to commit suicide in order that foreigners might be supplied with yellow dyed goods. After deliberating in private for some time, the jury returned a verdict to the effect that the deceased had died from lead poisoning, caused by the firm neglecting to carry out the promises made by them three years ago. Mr. Rogers, H. M. Inspector of Factories, and Dr. Niven, Medical Officer of Health for the city, were present at the inquiry. Mr. Pearson watched the proceedings for the firm.

A COMBINED CRUSHING MILL, AMALGAMATOR AND ORE CONCENTRATOR.

The mill shown in the illustration is designed to perform its work rapidly and effect the utmost possible saving of gold and silver. It has been patented by Mr. Samson Beer, of No. 645 West Granite Street, Butte, Montana. The bed plate is slightly thinner at its outer edge, so that the tapering crushing rollers fit and follow it nicely, and it has a central well in

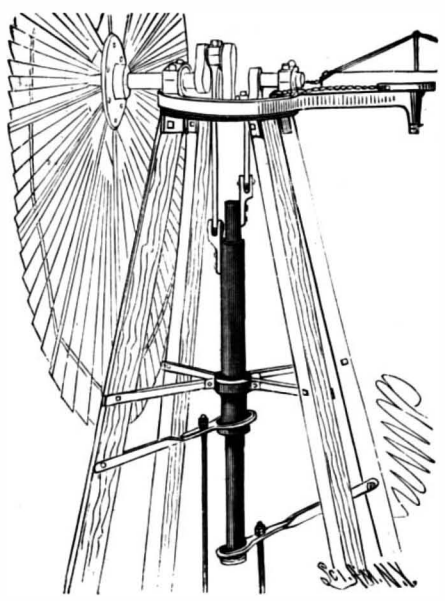


BEER'S MILL AND CONCENTRATOR FOR TREATING AND AMALGAMATING ORES.

which the quicksilver may lie, this well being supplied through a duct from an amalgam box on the outer side of the tub. Extending up through the center of the tub is a shaft casing, preferably cast integral with the bed plate, the driving shaft being stepped in a suitable bearing below, and on the shaft is a spider frame having at its top a collar which turns above the casing, and is keyed to the shaft. The lower ends of the arms of this spider frame merge in a collar on which are lugs between which are pivoted the shafts of the crushing rollers, which are thus allowed to swing vertically, that they may ride over any large or particularly hard rock without doing damage. In the tub, just above the rollers, is a cross frame of parallel cross plates connected by diagonal plates, to check the rotary current of water, so that the quicksilver in the central basin will not be disturbed. The tailings flow out with the water from a spout at the top of the tub, the free metal amalgamating with the quicksilver, while the concentrates settle on the bed plate. At one side, near the bottom, is a valve-controlled pipe through which the concentrates may be drawn out.

A PUMP GEAR FOR WINDMILLS.

With the construction shown in the engraving the wind wheel is free to turn to the wind without affect-



ERICKSON'S PUMP GEAR FOR WINDMILLS.

ing the position of the pump plungers, and the power of the windmill crank shaft is uniformly transmitted. The improvement forms the subject of a patent issued to Mr. Andrew S. Erickson, of Holdrege, Neb. On the shaft of the wheel are two crank arms connected by pitmen to two tubes, one sliding in the other, the outer tube being mounted to turn and fitted to slide in bearings attached to the tower. The lower ends of the tubes have flanges on which rest the eyes of two levers fulcrumed on the tower, and these levers are connected with the pump rods to impart a reciprocating motion to the pump plungers. It will be seen that, as the tubes are alternately raised and lowered by the motion of the wheel, the turning of the tubes, as the wheel turns in the wind, in no way affects the position of the levers connected with the pump rods, the eyes of the levers only loosely engaging the lower ends of the tubes. It will be obvious that a solid rod may, if desired, be used for the interior tube.

Railway Grade Crossings.

The blindness of city officials to the great and daily dangers to which citizens are exposed by the practice of permitting street railways to cross the tracks of steam railroads at grade is becoming so serious a matter, says Railway Engineering, that some kind of a surgical operation seems necessary to restore their sight. Nor does any thought of the rank injustice which the steam railroad suffers ever flit through the minds of those who grant franchises to street railway corporations. Here is a steam road with its right of way already established, and crossed by streets which may have been laid out years after the railroad entered the territory; a street railway corporation gets a franchise permitting it to use the streets without payment of anything but the boodle necessary to get the ordinance through the council, and then it essays to cross the tracks at grade, exposing its patrons to unnecessary danger, and compelling the steam road to share in responsibility for the lives of the passengers carried by the street railroad company. The cities of the land are anxious enough to have the steam roads elevate their tracks, but they do not display the same anxiety to protect citizens from the danger of street railway travel.

We believe that they will be awakened from this lethargy at no distant date by the electric railroads. The latter have a suitable power for high speeds, and the desire on the part of the populace for rapid transit already has and will compel them to adopt fast schedules, until when they successfully compete with steam roads for suburban travel the necessity for greater precautions for the safety of human life on street railways will be shown in no uncertain manner. On the question of electric and steam railroad crossings, the directors of the Pennsylvania Railroad, in their forty-seventh annual report, after describing the work of elevating and depressing its tracks in several cities, said:

"The object sought to be attained, however, through the large expenditures made in this direction, both by the railroads and the local authorities throughout the State, will be almost entirely defeated if the electric railways now being promoted throughout the country are permitted to cross the steam railways at grade, and thus create a new and most serious element of peril for the traveling public. It must be borne in mind that the entire movement of these electric railways is in the transportation of passengers, and that, therefore, the risk to life and limb from such crossings, owing to the frequent service, is proportionately much greater than on the steam railways, where the trains are not nearly so frequent, and where the movement is made up largely of freight traffic. It would hardly seem reasonable that the electric railways should be permitted to indefinitely increase the number of these crossings, while at the same time your company and the city of Philadelphia are expending over $400,000 to remove the grade crossings of your road by the North Pennsylvania Railroad in the northern portion of the city."

The directors of the New York, New Haven & Hartford Railroad in their report also refer to the matter as follows:

"The creation of level crossings of steam railroads by electric roads, whether by legislative or judicial permission, must lead to dreadful accidents. The people are calling for large expenditures by the steam railroads for the elimination of all grade crossings, and simultaneously their agents are increasing the danger to those which exist by allowing the electric roads to use them. Public sentiment sooner or later will condemn such inconsistency."

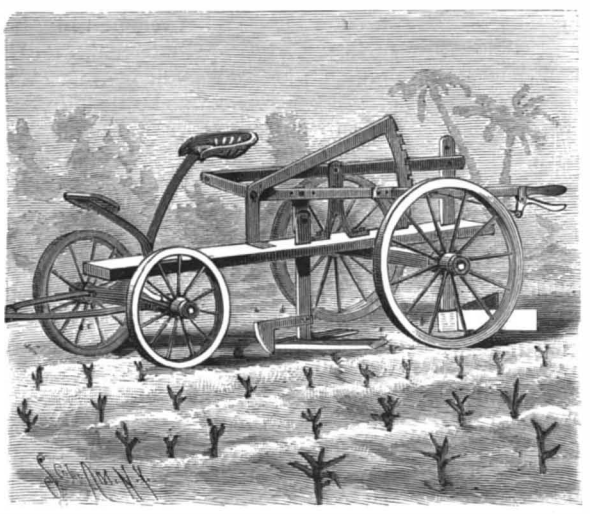
Punch Photograph.

The Consolidated Traction Company gives very liberal transfers, enabling citizens of Jersey City and Newark to go from almost any place in either city to any place in the other. To prevent cheating, the company has devised a ticket, on the top of which are printed in a row the faces of five men and two women. There is a smooth-faced man, the man with a mustache, and another with side whiskers, a fourth with chin whiskers, and the fifth with a full beard. There are only two women—one meant to be young and the other old—a hat designating the former and a bonnet the latter. There is also, as an additional safeguard, a mark just under the heads, which when punched according to instructions shows the age of the holder to be more than or less than forty years.

A SUGAR CANE CULTIVATOR.

The illustration represents a light, easily working machine, to loosen and clear the soil of weeds and vines, and throw it around the roots of opposing rows of cane. It has been patented by Messrs Louis Danos and Albert Haydel, Hohen Solms, Ascension Parish, La.

The platform of the truck is narrow, and supported centrally under it is a triangular scraper with a knife at its apex or front edge, the convex edge of the knife dividing the soil and severing vines, weeds, etc., in its path. The knife is attached by means of a shank to the standard of the scraper, which extends upward and is pivoted to a link adjustably attached to a hand lever fulcrumed just back of its forward end to an upright on the platform. Extending rearwardly from this upright is a rack upon which the lever has a guided movement, being provided with the usual thumb latch to engage the rack. A second lever, pivoted on a rear standard, is pivotally connected at



DANOS AND HAYDEL'S SUGAR CANE CULTIVATOR.

its forward end with the front end of the hand lever, and at its rear end this lever is adjustably attached to the upper end of a shank or standard on whose lower end is secured a follower or mould board, which travels over the surface that has been operated on by the forward scraper. As the machine is drawn between the rows of cane, the hand lever is pressed downward, bringing the scraper and its cutting knife into the desired engagement with the ground, the same motion also bringing down the mould board, by which the loosened soil is thrown to both sides and upon the roots of the plants.

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CURIOUS AND INTERESTING WATCHES.

A watch made entirely of iron, of comparatively crude but still most interesting workmanship, is shown in the central picture herewith, its engraved dial marking the hours from 1 to 24. There are two hour circles, an outer and an inner one, and the watch has an hour hand only. It is of the type known as saddle watches, and has both a barrel and fusee, being probably one of the oldest specimens of a watch with this maintaining power, according to the American Jeweler, to whom we are indebted for illustrations and details.* A catgut string is used in lieu of a chain for connecting the barrel and fusee, and the balance is in the form of a straight bar, like those found in old Black Forest clocks, instead of the circular balance now in use. The edge of the case, which was evidently cast and then chased and finished, has an artistic frieze, the motive being birds and foliage. The watch is apparently of German workmanship, and probably more than three hundred years old.

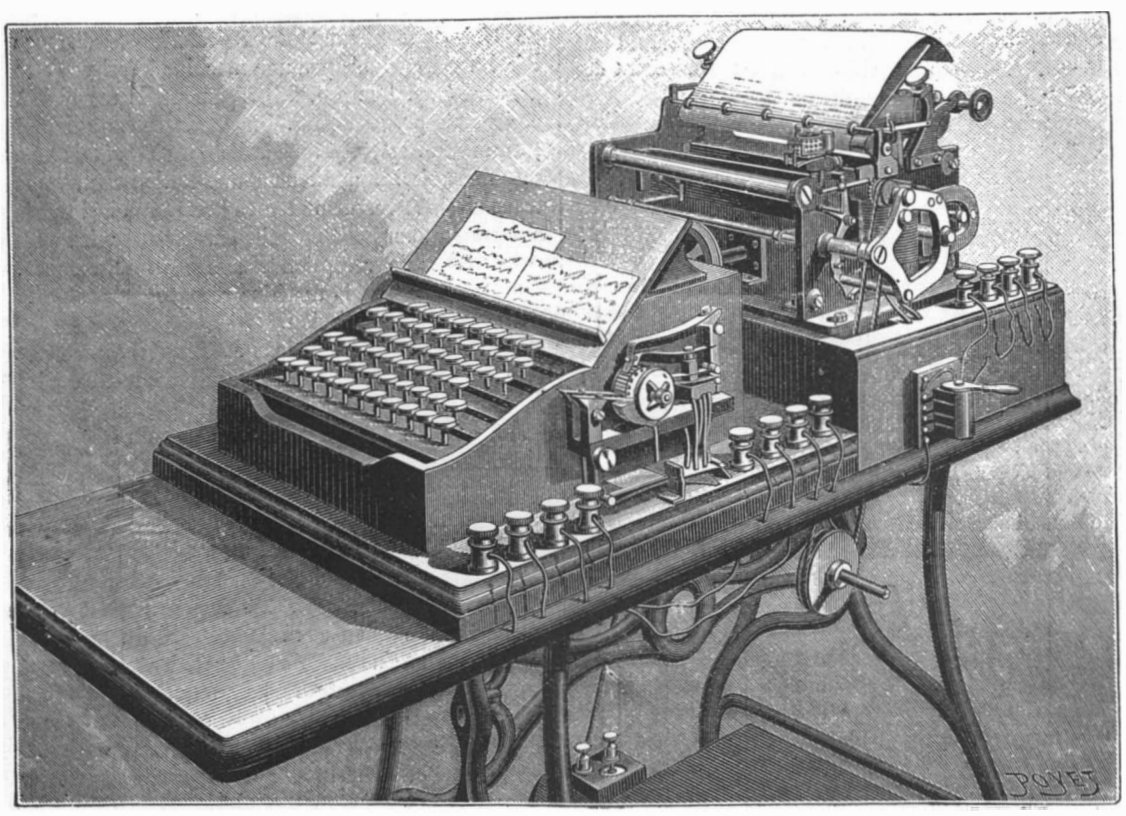
The egg-shaped watch, shown in side and face views, at either side, was made by Denis Martinot, Paris, in the 16th century, and is of gilded silver. Its dial illustrates the three elements, air, water and earth. Jupiter, sitting on his throne and surrounded by clouds, represents air; Neptune, holding aloft his trident in his right hand, inside the dial circle, simulating water; while below the dial reclines a mythological figure designed to represent the earth. Surrounding these figures is a delicate design of conventionalized leaves and flowers. On one side of the case is represented Fame holding a laurel wreath, while opposite is the reclining figure of a warrior, and between them is a drum and antique shaped gun. On the other are other reclining figures representing a herald and the god of war. The watch has an hour hand only, and the movement is richly ornamented to correspond with the case.

CURIOUS AND INTERESTING WATCHES.

THE TYPEWRITER TELEGRAPH.

The quick transmission of news has become one of the most imperious needs of our age. The public wishes to be informed at every instant, and in as short order as possible, as to the most recent occurrences of every kind. To cite but a few examples, we may mention as particularly interesting the mind of the public the races, the various sports, stock operations, political events, etc. The present means that we have at our disposal in Paris for obtaining information are really inadequate, and the telephone itself has not been able to remedy the matter. It became necessary to adopt other arrangements in order to meet the requirements of the present hour.

The Havas agency at Paris has been endeavoring to find a solution of this difficult problem for ten years past, and has finally cast eyes upon a printing telegraph invented by Mr. Wright, an American. This telegraph permits of reproducing at a distance the matter printed by a typewriter. Our engraving represents the latter in the foreground. The manuscript to be transmitted is printed at a distance by means of a writing machine located in a central transmitting station. The matter thus printed is reproduced at the same time in registering apparatus installed in receiving stations at the houses of the various subscribers. In our figure, the receiving machine is shown at the rear of the transmitting one.



WRITING MACHINE FOR TRANSMITTING A MESSAGE TO A DISTANCE.

After many hesitations and difficulties, it became possible to install a service which is now operating in the offices of the Havas agency, Place de la Bourse. Mr. Nigron, superintendent of this service, has been kind enough to explain the system to us and show us the mechanism of it. We shall be content in what is to follow to point out the general principle solely. The entire number of our journal would scarcely suffice to give a detailed description of the different apparatus.

In one of the halls of the Havas agency is installed a central station that constitutes the transmitting post. A writing machine with keys actuates a special commutator that permits of sending currents into a line upon which are arranged various receivers or writing machines. These latter are genuine masterpieces of mechanics, without clockwork movement. A type wheel, upon which the various letters of the alphabet are engraved in relief, obeys the currents that are sent from the transmitting station and prints the transmitted characters upon a roll of paper. There is no longer a question here, as in the old American machines, of a band of paper three-quarters of an inch wide, but rather of a roll five and a half inches in width. It is therefore possible to obtain a sheet constituting a true document. Without dwelling at length upon the interior details, we shall say that the commutator, of which it is a question above, is set in motion by means of a small electric motor, which receives the electric energy necessary for its operation from a battery of sixty Tudor accumulators. The charge of these elements is effected by the aid of a deviation taken from the Edison sector.

The transmission in the exterior circuit of the apparatus is made at a difference of potential of 100 volts and with an intensity of 0·38 ampere. The Havas agency is at present performing two services, the race track and the financial. It is supplying about forty-five subscribers distributed to the number of fifteen per circuit. The number of subscribers per line is not limited, but the derangements of the service can be restricted in case of accident by diminishing this number on each line. The cables necessary for such transmissions are strung in the sewer by the care of the state. These apparatus may be seen in the large hall of the Comptoir d'Escompte at Paris, where they are in regular operation. The roller is seen moving forward at every instant and becoming gradually covered with numerous inscriptions.

The advices thus transmitted are most valuable. In the financial service, all the foreign quotations of the evening are furnished to the subscribers the next morning. The distributions continue thus from instant to instant during the entire day, and especially at the moments of activity at the Exchange. All the dispatches received from every quarter by the Havas agency are immediately sent out as soon as received in the office. The information relative to the service of the races is also very curious. If it is a question of an important affair, the particulars telephoned from the race track to the agency are transmitted at the moment of starting, at the third stretch, half stretch, finish, etc. A race has scarcely terminated before a subscriber has been able to foresee the results of it. The great interest that a service of this kind may present may be readily seen. The price of subscription, moreover, is not high, it being $300 a year for the financial service and $120 for that of the races.

The Havas agency will not stop at the two services of which we have just spoken. It is working at present at the installation of a third service for the supplying of political news. The machine utilized will be more powerful and more rapid than the preceding. All the machines necessary are not yet ready, but we have already been able to see some models of them, one of which we give a general view of in the figure. In the foreground is the transmitter or writing machine that serves to establish the contacts necessary for the electric transmission. Back of this is the receiving apparatus, like those that are installed at the houses of the subscribers. At the top is seen the band of paper that unwinds opposite the type wheel that does the printing.

These present arrangements, imported into France for the service of rapid distribution of information, prove to us that the proverb "Time is money" does not remain English, but is becoming universal.—La Nature.

Injury to Boilers by Grease.

It has often been observed that small quantities of grease in combination with deposits lead to boiler accidents. This compound gets deposited on the plates, and the most violent water circulation is sometimes insufficient to remove it. The plates, in consequence, get overheated and accidents arise. The introduction of grease inside the boiler should be avoided, especially where the water from the condenser is used for feeding the boiler, by the use of a sufficiently large feed water filter. The Berlin Boiler Inspection Society had the following case brought under its notice: Two single-flued boilers, 4 feet 8 inches diameter, 23 feet long, flues 28 to 22 inches diameter, pressure 12 atmospheres, were used to generate steam for a 150 horse power engine with surface condenser. The installation had only been in work since July, 1893. A considerable portion of the flue of the left boiler had collapsed. This could not be attributed to shortness of water. On examination it was found that nearly all over the boiler a fatty brown slime had been deposited, which, being placed on a red hot iron, burst into flame. The feed water pump got its water from a large open tank over which a small filter was placed. The condensed water was led to this filter in order to have the grease removed. Unfortunately, the arrangements were so bad that a considerable portion of the grease found its way into the boiler. A similar case was recorded by Mr. Abel at the last meeting of the Markisch Society of Testing and Inspecting Steam Boilers. Four boilers, the feed water of which was heated by the exhaust steam from a Westinghouse engine, after being in use about six weeks, were so damaged that one boiler had to be completely removed; the other three had to receive extensive repairs. An examination of the boilers showed that the flues were covered with a deposit of fatty slime. An analysis of this showed that about 52 per cent of it consisted of mineral oils and paraffine, and 27 per cent of animal fat. It is strongly advised, therefore, that feed water shall always be filtered so as to remove any oils or grease.

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The Florida Sponge Industry.

BY WILLIAM B. BURK.

Sponge is a substance with which almost everyone is familiar, as there are but few living in civilized communities who do not find occasion to use it for a great variety of purposes. The article is so very useful that a large number of inconveniences would arise if it could not be obtained. Without it, what would the surgeon, the traveler or the housekeeper do? And yet most of those who use sponges in an infinite variety of ways all their lives never stop to consider how they are formed; that is, whether they are plants or animals, or what their history or habits may have been.

Sponges consist of a framework or skeleton, coated with gelatinous matter and forming a non-irritable mass, which is connected internally with canals of various sizes. The ova are very numerous, and present in appearance the form of irregular-shaped granules derived from the gelatinous matter which grow into ciliated germs, and, falling at maturity into small canals, are then expelled through the orifices. When alive the body is covered by a gelatinous film, which, being provided with cilia, causes a current of water to pass in at the smaller pores and out at the larger apertures, the sponge probably assimilating the nutritive principles contained in the water.

Sponges are found abundantly in tropical waters generally. They gradually decrease in numbers toward the colder latitudes till they become entirely extinct. They vary much in shape. Some are shaped like a vase, others are semi-cylindrical, others flat like an open fan, and some are round.

The commerce in sponges is of considerable importance. The great difficulty which is experienced in any attempt to distinguish species results from the extreme susceptibility of all keratose sponges to any change in external conditions. They appear to require for the production of the forms in abundance tropical or subtropical seas, and attain by far their greatest development in the number of the forms and species in the Gulf of Mexico and West Indian seas. The typical forms, the commercial sponges, are essentially confined to the waters of the Bahaman Archipelago and the southern and western coasts of Florida in the western hemisphere and to the Mediterranean and Red Seas in the other.

The Florida sponge grounds form three separate and elongated stretches along the southern and western coasts of the State. The first includes nearly all of the Florida reefs, the second extends from Anclote Keys to Cedar Keys, and the third from just north of Cedar Keys to Saint Mark's. The Florida grounds have a linear extent of about 120 miles, beginning at Key Biscayne, in the northeast, and ending in the south at northwest channel, just west of Key West. The northwestern half of the grounds is very narrow, having an average width of only about five miles, and being limited to the outer side of the reefs. At about the Matacumbo Reefs the grounds broaden out so as to cover the entire width of the reefs, which are much broader here than at the north. The entire southern half of the grounds has more or less of the same breadth, which is about 13 or 14 miles.

The second sponging ground begins just south of Anclote Keys, with a breadth of 7 or 8 miles, which it maintains from a point opposite Bat Fort to Sea Horse Reef, just south of Cedar Keys. The total length of this sponging ground is about 60 geographical miles. Its distance from the shore varies somewhat. At the south the inner edge approaches within 4 or 5 miles of the mainland, and comes close upon Anclote Keys; but throughout the remainder of its extent it is distant 6 to 8 miles from the shore until it touches the shallow bottom and reefs of Cedar Keys. The depth of water on these grounds, as indicated on the coast survey charts, ranges from 3 to 6 fathoms, but many portions are undoubtedly shallower than this. The northern ground, which maintains a nearly uniform width throughout, is about 70 miles long by about 15 miles broad. It approaches to within about 5 miles of the shore and terminates just off the mouth of Saint Mark's River; the depth of the water is the same as upon the next one to the south, i. e., from 3 to 6 fathoms. The total area of the Florida sponging grounds, which are now being worked, including also those that were formerly fished upon, but have since been more or less abandoned, may be roughly stated at about 3,000 square geographical miles. This probably does not include all of the sponging grounds occurring in Florida waters, for the fact that new areas are being constantly discovered would indicate that there might still be more to find, and it is certain that no strenuous efforts have yet been made to extend the grounds already known, the discovery of new ones having generally been made by accident.

The sponge fishery of the Florida coast differs from that of the Mediterranean, in that sponges are not obtained by divers, but by means of a long hook fastened to the end of a long pole and managed from a small boat.

In Florida small vessels of from 5 to 50 tons measurement are employed to visit the grounds to afford quarters for the men and to bring home the catch. These vessels are generally of light draught and schooner rigged, having proportionately large decks on which to carry boats, working gear and the sponges caught. The holds are of considerable size, for storing the sponges, and the cabins generally small, indicating a sacrifice of comfort to working room. Each vessel carries, according to its size, from five to fifteen men, one as cook and the remainder as fishermen, and also a small yawl boat to every two fishermen, to be used by them in securing the sponges. In addition to the working tools for taking sponges, they are provided with a sufficient quantity of provisions, wood and water for the trip, lasting from four to ten weeks.

The working outfit for a Florida sponging vessel consists of a few small yawl boats, called dingies, and a supply of sponge hooks and sponge glasses. The boats used are always made as light as possible. They are from 15 to 20 feet long and from 4 to 6 feet wide. The idea is to have the boats light enough to enable two men to haul them in and out over the side of the vessel, and yet strong enough to withstand the rough handling which they are sometimes subjected to, and to carry the heavy loads resulting from a day's catch. While catching sponges it is necessary to scull the small yawl boats (dingies) from the stern, and, for convenience in doing so, this form of sculling notch is used: A piece of oak plank about 6 inches wide and 1 foot long is notched at one end to fit the oar and inserted at the other between two guiding strips well fastened to the stern sheet. This sculling notch is placed at one side of the center of the stern sheet and is made to be easily removable in order that it may be taken out of the way when not needed. The sponge hooks are made of iron with three curved prongs, measuring about 5 to 6 inches in width. The entire length of a hook is about 8 inches, the upper end being made into a very strong socket for the insertion of the pole.

The sponge glass is made from an ordinary wooden bucket, the wooden bottom being replaced by one of ordinary window glass securely fastened by cement. In using a sponge glass it is placed upright on the surface of the water, the handle of the bucket is placed on the back of the neck of the fisherman with his head thrust down in the bucket. In this way the fisherman can distinctly see very small objects in very deep water, and he can easily distinguish good sponges from those of an inferior grade.

When the sponger discovers a suitable sponge through the aid of the sponge glass, he hurriedly grasps his hook, and, plunging it directly upon the sponge, he skillfully pulls it from its habitation and brings it up to the surface and places it in the boat. As soon as the fisherman collects a sufficient quantity, he takes them to the vessel, where they are spread carefully on the deck in their natural upright position, so as to allow the slimy matter, called "gurry," by the sponger, to run off. During the first stages of decomposition they have a very unpleasant odor, something like decayed fishy matter. After the dingies collect sufficient sponges to make a vessel load, they are taken to what are called sponge crawls, which is an inclosure of about 10 to 12 feet, made generally by placing stakes in the beach where the water is from 2 to 3 feet deep.

Sponges, after being kept on the decks of the vessel from one to two days, will generally be sufficiently cured to be taken to the crawls, and then they are kept there for a few days and then thoroughly washed and pounded with a flat stick. They are then placed upon strings of about 6 feet in length and taken to the markets, where they are sold at auction. They are generally sold in lots, and then carefully trimmed and packed in bales weighing from 15 to 100 pounds each, according to quality, the cheaper grades being generally packed in the larger bales.

The principal varieties of sponges found in Florida are the following: sheep wool, yellow and grass. The Florida sheep wool are the best quality, being of very fine texture, soft and very strong and durable. The yellow sponge is of fine quality, but not strong in texture, and not near as soft or durable as the sheep wool sponges. The grass is very much inferior to the others, not being as strong nor so desirable in shape, and being easily torn.

There are no sponges found in the world to equal the Florida sheep wool for softness and strength, and no better bath sponge can be found than a good solid Florida sheep wool, although they are generally sold for washing carriages, etc. In former years Florida sponges were loaded with lime or sand in order to decrease the price, but of late very few loaded sponges have been placed upon the market.

Sponges in great variety are also found in many places in the West India Islands, also in Cuba. The Cuban sponges are the next best to the Florida. The principal varieties found in Cuba or the West Indies are sheep wool, reef, yellow and grass, also velvet, which are next best to the sheep wool.

The finer grades of sponges are found principally in the Mediterranean, such as the fine surgeon's, toilet, bathing and nursery sponges, and they are very much higher in price than any others.

Florida produces nearly double the amount of sponges that are imported from all other countries, that is, in value, not quantity, and the demand for good Florida sponges is considerably greater than the supply. Consequently, the prices must advance from year to year. The prices have more than doubled, within the last twenty years, for Florida sponges.

The fine, soft species of sponges, such as surgeon's, toilet, nursery, bath, etc., are found in great variety in the Mediterranean, and are fished principally by divers, sometimes at great depth. After being brought to the land they are buried in the sand and allowed to decompose, after which they are well washed and beaten with a small stick, and then packed in bags and sent direct to London, and again thoroughly cleaned and packed in cases according to size and quality. The large London dealers have almost complete control of the sponges found in the Mediterranean. There are a great many varieties found there, principally the fine surgeon's, toilet, bathing, potter's, fine thin flat (called elephant's ears by the native fishermen), fine cups, Zimocca toilet, Zimocca potter's, etc. Some of the finest cup sponges are sold at as high as $100 per dozen. The Mandruka bath sponges are also very expensive and very rare. Some of the cheaper species are also found in the same waters, but none like those found in Florida or Cuban waters.—Amer. Jour. Pharm.

Progress of Irrigation.

The irrigated and irrigable lands of the western part of the United States are mainly included between the one hundredth meridian and the Pacific Ocean, and comprise, according to official surveys, about 610,000,000 acres. Within this great extent of country are nearly all possible combinations of soil and climate. In a general way, however, four great classes may be distinguished. These are desert, pasture, firewood and timber lands. Of these, the desert land is practically valueless, the pasture land is too arid to support vegetation and may be used only as a pasturage, and only the two latter divisions are more or less fertile. The irrigated sections are included in the desert and pasture lands. At present some 3,631,381 acres, or less than six-tenths of one per cent of the entire region, have been provided with an artificial water supply sufficient to raise crops.

The proportion of this desert or pasture land which may in the future be brought under irrigation depends, of course, upon the thoroughness and ingenuity with which the water supply is utilized, but it is probable that it will be under 3 per cent of the entire area. Statistics show, however, that irrigation is a profitable measure and cannot be neglected. The average cost of water for irrigation throughout this section is at the rate of $8.15 per acre. Applying these figures to the total acreage the total first cost of irrigating the lands last year was about $30,000,000 and the total value of the water right was $94,412,000, the increase of valuing being $64,800,000, or 218·84 per cent of the investment. The estimated first cost of the irrigated lands from which crops have been obtained was $77,500,000 in 1889, and their present value, including the improvements, is $296,850,000, showing an increased value of $219,360,000, or 283·08 per cent of the investment in the land. The average value of the crop raised was $14.89 per acre, or a total of $53,057,000. This, it must be considered, exhibits merely the cost and value of irrigation in the arid regions. The value of the unutilized water supply can scarcely be estimated.

During the past four years the federal government has done much to further the work of irrigation by establishing an irrigation survey and by appointing State engineers in California, Colorado and Wyoming, whose duties are practically confined to irrigation.

At present the irrigation of this region is carried on by what is called gravity irrigation.

The different systems adopted by modern engineers may be classified as perennial, periodical and storage work, by irrigation from artesian wells and from subsurface sources. The perennial irrigation includes the supply of water from canals which receive their supply from streams which give a constant supply of water throughout the entire year.

Periodical irrigation includes the canals which have a supply only at certain seasons of the year. A more common plan, however, is the storage system. The dams for this system are generally constructed on intermittent streams for the purposing of receiving and preserving their flood waters.

The irrigation from artesian wells is practiced wholly by means of canals, which convey the water to the land directly from the wells. And the irrigation from ground water sources is performed by tunnels under the beds of streams, which tap some water-bearing stratum or by cuts in sloping ground, by wells to collect the ground water and by similar contrivances.

The work of irrigation calls for much skill and scientific knowledge. Climate, geology and topography must all be considered in the work. It is to be hoped that the skilled engineers now at work on the subject will provide an economical and efficient system for the future.

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Correspondence.

The Snows of Mars.

To the Editor of the SCIENTIFIC AMERICAN:

During the past few months your valued publication has contained a number of interesting articles on various phases of Mars, its probable climate, etc., and the idea generally comes to the surface that the supposed snows of that interesting planet may, after all, be chemical snows, and not crystals from the frozen vapor of water.

While we must not forget the fact of our present nescience relative to the actual conditions on the distant surface of our interesting neighbor, have we any just reason for assuming that the temperature of that planet is too low for the abundant and rapid transformation of the forms of water such as we know them?

Here in the plains country, where the intensely clear sky and high altitude favor radiation and absorption in a high degree, it is no unusual thing to see numerous large and abundant crystals of frost (a feathery snow, in fact) fall from an almost cloudless sky when the mercury is at zero or below. It is a much more common thing to see snows of half an inch in depth evaporate and totally disappear when the mercury is anywhere from zero to 20° below, and the writer found that a cake of ice about 18 inches square, when hung up in the shade on the north side of a fireless building and with the mercury at zero or below, lost about four ounces per day under those conditions.

It is a very popular mistake to suppose that evaporation ceases at the freezing point, and, for aught we certainly know to the contrary, the process of crystal forming and condensation may, under somewhat changed conditions, go rapidly on under negative temperatures below the deepest reach of our terrestrial thermometers.

E. W. BLACK.

North Loup, Neb., January 5, 1895.

Birds and Their Persecutors.

As matters go now, unless some stringent measures are taken, the birds of Europe will, in the next century, be as extinct as is now the dinornis. The ornithophil societies of France and Switzerland have more than once written to me that unless birds be protected in Italy they must perish all over Europe, since so great a variety of races wing their way to the south in winter, and there are ruthlessly murdered. Switzerland says that millions of her birds (insectivorous songsters) leave her for Italy in autumn, never in spring to return. No representation of this fact produces any impression on Italians; they do not believe that birds aid their crops and clean their vines. They wish to eat them; they are impervious to any other considerations, and so they continue to destroy lovely and useful little lives, butchered to lie in rotting heaps in the market places or be sold at two farthings a head. In autumn numerous tribes of northern nesting song birds come southward, and their piping and trilling is heard for a week or two in the fields and hedges, under the willows of watercourses and among the furze and chestnut scrub of the hills. Then it is silenced. Trap, or gun, or net, or poison have done their work. The huge low-spread nets called panatoie capture hundreds in a forenoon. There is no distinction or discernment in the wholesale murder. The decree is, Let every winged thing die.

Along the little streamlets, by the banks of rivers, among the reeds and rushes, anywhere where there is water, men wait at daybreak to snare or slay the birds as they come to drink; and again at sunset, when the birds, large and small, fly down to slake their thirst, the same brutal foes lie hidden to destroy them. As are the dog s'lives in the cities, so are the birds' lives in the country. They are hunted from dawn to dark. Even within the towns the birds are no safer; the blackcap and merle, the linnet and chaffinch, the bullfinch and goldfinch, which would be numerous in Italian towns were they let alone, are caught by nooses or shot without pity.

The thistle seed so eagerly sought and eaten by the goldfinch should make that beautiful bird precious to those who have neither sight for his plumage nor ear for his song. The grubs and larvæ of injurious insects turned up by the bills of blackbirds and nightingales should render them sacred to those to whom their melody says nothing. All the tribes of finches are invaluable as grub hunters and aphis eaters on the grounds where they feed and breed. Italian agriculturists bitterly bemoan the fact that their fields are ravaged by insect hordes of every kind, that their fruits drop off unripe, and that their vegetables are eaten to the root by snails and caterpillars, and through the root by wireworms and grubs. There is, indeed, a close time in most countries, but it is too short to be effective; it begins too late to protect birds in their amorous season, when they are most easily approached and taken, and ends too soon to save the later young broods from being seized or shot while scarcely fledged.

I have repeatedly seen during the close time linnets, finches, grosbeaks, and nightingales hawked wild in the streets of Rome by boys who held them at the end of a string, and flung the terrified little things into carriages or shops, or on to people's shoulders, on the chance of sale.

Mosquitoes, flies, wasps, moths, caterpillars, large and small, and the red ant, which swarms in houses and devours all kinds of food with incredible rapidity, all these are a hundredfold more numerous than they were in bygone years; while the great ash-colored locust appears in millions, which cover and desolate whole districts, leaving no green blade or leaf alive. Whose is the fault? Who lets the larvæ-eating and the insect-killing birds be murdered in the very season of their usefulness? Who lets the swallows, who would rid the air of winged pests in their graceful circling flight, be shot down in scores as they flash in the morning sun or skim the water at eventime for a bath and drink? I have known hundreds of swallows and martins come to make their nests as April brought them home, and I have known these innocent and useful returning pilgrims destroyed almost entirely before June was passed, two or three at most being left of the happy bands which had come back so joyously and trustingly to the roofs of men. The penalty for slaying a swallow or martin could not be placed too high. All day long and until it is quite night this bird seldom rests, and in his buoyant flight is ridding the air of men's worst pests.

There is a horrible night method also of taking nesting birds which is common in all parts of Italy. Men tie lanterns to long poles and shove the lights up into the trees, or vines, or bushes, with much noise and hooting; the shifting lights so terrify the birds, wakened out of their sleep, that they fly madly to and fro, and fall an easy prey to their persecutors.

This is considered a very amusing diversion, and children are allowed as a treat to crush the skulls of the little birds snared in the nets. The duke and duchess are as eager for these noble pastimes as their plowman and his wench. The amusement of the uccelliera pleases high and low alike. The prince and cardinal find a great glee in its stupid butchery, as do the country lout and city cad. The patrician woman claps her jeweled hands, and the sleek ecclesiastic purrs with pleasure as the victims are snared, caught, and either killed or caged.

Legislation as regards birds is environed with many difficulties. It is hard to know how a law is broken over miles of wild country, within park walls along solitary shores, and on lonely hillsides. But great good would be effected if birds were prohibited as food; if all nets, traps, gins, bird lime, and call birds were made illegal; and if punt shooting and night netting of water birds were forbidden. In Italy, if birds were not allowed to be brought within the gates of a town, their slaughter and capture would be much diminished, and if the gun tax were raised, the crowds of cads who ravage the country fields would be greatly lessened. If the uccellario and panatoie of the richer classes were made unlawful, the numbers thus sacrificed would be also much diminished. As many as six or seven hundred birds of all kinds are frequently caught in one morning by these means on a single field or in a single shrubbery.

Consider the marvelous life of a bird and the manner of its whole existence. Men must truly be brutes not to be moved by wonder and admiration before a creature so ingenious, so courageous, and so persecuted. Consider the powers of that little mind of which the inner light flashes from the round, bright eye; the skill in building its home, in finding its food, in protecting its mate, in serving its offspring, in preserving its own existence, surrounded as it is on all sides by the most rapacious enemies. Consider its migration. Men are proud of the steamships and railway trains of the overland route between Europe and India, but what merit have they beside the flight of the bird from Northern Europe to Southern Asia? Alone, unaided, opposed by many adverse circumstances, and frequently blown back by weather, it yet crosses continents, seas, and deserts, till it reaches its winter home by Nile, or Ganges, or Euphrates; and yet again, when spring is in the air, returns over those thousands of miles to make its nest in some Norman croft, or Rhenish hedge, or English orchard. The migratory flight of the bird is the greatest miracle of nature. It is sad and amazing that it is regarded by man with entire indifference, and merely utilized by him for his own gain or diversion.

All the tendency of modern life is set against the continuance of what is called "wild life"—i. e., such forms of life as have continued to exist in a natural state, without artificial aids or restrictions; the only forms which are really beautiful.

When left alone it is such a lovely little life—cradled among the hawthorn buds, searching for aphidæ among apple blossoms, drinking dew from the cup of a lily; awake when the gray light breaks in the east, throned on the topmost branch of a tree, swinging with it in the sunshine, flying from it through the air; then the friendly quarrel with a neighbor over a worm or a berry; the joy of bearing grass seed to his mate where she sits low down among the docks and daisies; the triumph of singing the praise of sunshine or of moonlight; the merry, busy, useful days; the peaceful sleep, steeped in the scent of the closed flowers, with head under one wing and the leaves forming a green roof above.

In winter, doubtless, it is hard work for him to keep himself alive and warm; but the bird is a little philosopher, and he wears a waterproof coat. Pious people rob him of his natural food in hedge and thicket that they may decorate their churches with holly and mistletoe and bay, and when the frosts are long and the snow is deep the non-migratory bird suffers greatly; often, indeed, the cold kills him, if he escape the gun and the trap. But in southern countries, like Italy, he fares well if he be let alone; and in northern countries people might easily help him if they would but spare him some grain, some seed, some crumbs of bread, some bones of meat hung in the branches where he can reach them and animals cannot.

Every invention in the programme of what is called civilization is against the creatures of wood and water and air. The beaver is almost extinct, the mole is incessantly hunted, the hare is harried to death in every country; the steam plow, the steam reaper, the steam engine drive before them millions of once happy and woodland-born creatures; and the birds suffer more than any other living thing. The great electric lights of the lighthouses on the coasts and islands slay hundreds of thousands of the birds of the sea and of migratory song birds, as they dash in headlong flight against the revolving glare, and fall dead from the shock on the rocks below. When the tired flocks of the air land on some seashore, worn out with fatigue, half dead with thirst, obliged to seek a day's repose before continuing their flight, the human brute receives them with stick and net and gun. There is no hospitality for the winged traveler; if he stoop to drink, if he pause to rest, if he plume his ruffled feathers on a tussock of grass, his enemy is down on him, the two-limbed human brute, who is more cruel than any bird or beast of prey. There is no sympathy with his courage, no aid to his weariness; even a drop of dew or a wayside seed is begrudged to him. He must perish, to be ground between the yellow teeth of peasants, or, perchance, lie dead in crates, or be skinned, that his pretty plumage may be worn on the heads of female fools. Every rush-covered islet on a stream, or a lake, or a broad has its murderous punt shooting. Every stretch of waste land or belt of common wood has the caterer for the fashions of women, spreading his toils or setting his mirror traps for the songsters and the swallows. Every child is brought up to torment and hunt down the birds. No holiday seaside excursion is complete to the city cad and his "flame" without wounding some winged creature and seeing it struggle helpless in the surf of its native shores. Sometimes, if shot on the shore and taken in rough hands, its wings are torn off to adorn the Sunday hat of some 'Arry's girl, and the bleeding, mutilated body is thrown back alive into the salt waves.

Science is not the criminal here. The offenders are the whole public, of nearly all nations, who for greed, for sport, for dress, or for mere brutal horseplay, destroy all over the world the loveliest and the most marvelous of all the children of Nature.—Ouida, in the Nineteenth Century.

Injury to the Orange Crop.

Florida oranges, which have been wholesaling at about $2 a box, have advanced to $4 and $5, with a prospect, so Garden and Forest says, of a still further advance for good fruit, if any can be secured. The cold wave which visited Florida in the last days of December was the most disastrous known in the history of that State. Ice formed an inch thick as far south as Lake Worth, and in many other sheltered places where orange groves had heretofore been safe the fruit was frozen solid on the trees. The loss to the fruit growers, as well as the merchants, transportation companies, the packers and all those in any way connected with what promised to be a most profitable season has been almost as serious as if the State had been swept over by fire. Owing to the drought of last summer, the orange trees bloomed late in the fall, and there was promise of a large crop of late fruit. Of course, this is all destroyed, and the fruit buds for next year's bloom are probably ruined. Many young orchards are killed, and many of the old trees will be cut back seriously. The salable oranges now arriving in this city are those which had been picked and were in packing houses before the cold wave. Some oranges which were caught by the frost in transit bring little or nothing. Grape fruit now sells at $6 a box at wholesale, and the price is steadily advancing. To meet the deficiency caused by the disaster in Florida, large orders have been cabled for Messina and Palermo oranges, and Sicilian fruit now here is commanding high prices. Oranges are already selling in the groves in California at an advance of $1.50 a box. Apples and other fruit have not yet felt the effects of the scarcity of oranges, but all kinds of winter fruit will probably be dearer as they are called upon to supply the deficiency.

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THE NEW WAR SHIPS TEXAS AND OREGON.

(Continued from first page.)

and will carry two powerful electric search lights. She is to be used as a flagship and will be supplied with 368 officers and men. The machinery for the Texas has been built by the Richmond Locomotive and Machine Works, of Richmond, Va.

Needed Increase of the Army.

Recent numbers of the North American Review contain valuable articles on this subject by Gen. Ruggles and by Lieut.-Col. Wm. Ludlow. Only a very brief abstract can be given. General Ruggles shows how inadequate to present necessities is our establishment of 25,000 men, which in effect allows but 20,000 men for the fighting line. To properly man our modern seacoast defenses for a reasonably efficient defense in time of war would require 42,500 artillerymen, and as many more would be needed for the smooth-bore and rifled guns of the old armament, making a total of 85,000 men. It is not too much to ask, in consideration of the long and careful training that these men require, that one-twentieth of the war strength be maintained in time of peace. This would furnish a minimum peace footing of 4,250 heavy artillery troops, or seven regiments of 600 artillery, plus 50 mechanical and electrical engineers. These 4,250 men will afford meager garrisons for existing works at only the more important of our seaports, and will be simply sufficient for the ordinary care of their costly armaments. They will furnish a mere leaven of gunners for the total force required in war. That, from motives of economy alone, there should be this reasonable number of peace-trained gunners is evident from the fact that a single round of maximum cost, wasted, is equivalent to the pay of one soldier for five years, and that a single round of minimum cost wasted is equivalent to the pay of a soldier for about nine months. Like necessity exists for the instruction of the light artillery, the cavalry, and the infantry man. To the strength of the seven regiments proposed should be added for light artillery service 900 men. General Ruggles further shows how pressing and immediate is the necessity for artillery defense. "Independently of the disgrace which would come to us as a nation by the successful bombardment by an enemy of any one of our seacoast cities, the cost in money and the disaster which would thus be effected in a few days would far exceed the expense of proper defense for years."

We should increase our cavalry to 12 regiments, or 8,820 men, and our 25 regiments of infantry to three battalions with 80 men to a company, or 24,625 infantry in all. This would give a grand total in round numbers of 40,000 men. From this total it is proposed to deduct 9,500 men for skeletonized companies, making a minimum of 30,460, or 5,500 in excess of the present force. An inconsiderable increase of officers would be required, so that the increased expense would not be great, enlisted men costing $272 per year for each man, a total of but little more than a million and a half of dollars.

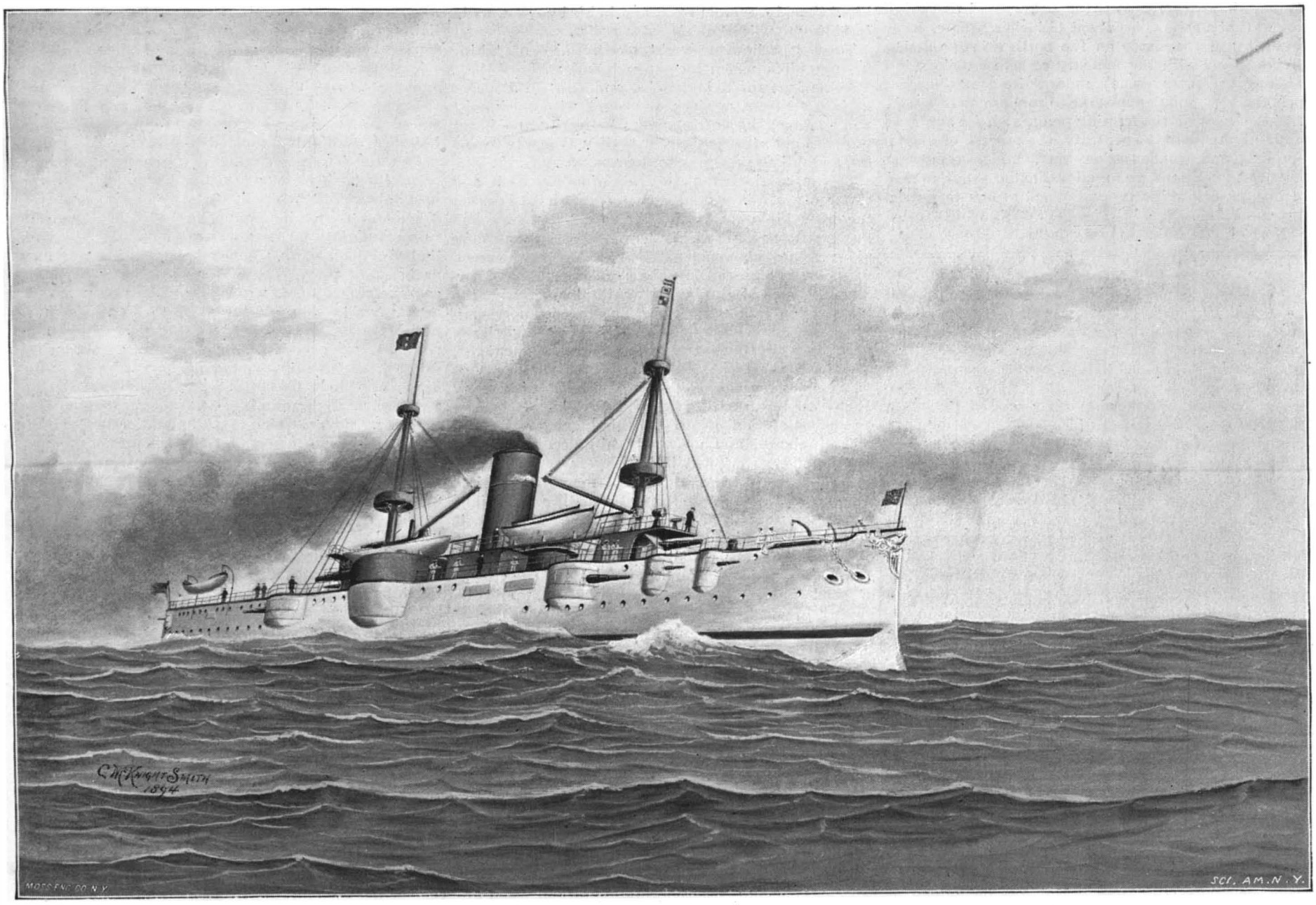
The conclusion of the whole matter as presented in Colonel Ludlow's able and interesting paper is this: "To be worthy of respect a government should be able to command it, and, since preservation of order is the object to be attained, there is needed so much of an organized force at the disposal of the government as should be able not only to restore peace, but to forbid its breach; and a nation that would relegate the maintenance of order to casual and insufficient means puts itself in the attitude of a city that, dispensing with a trained police, should intrust its security to its citizens alone, and presently would find itself at the mercy of the criminal and violent classes. In a well-ordered community it does not suffice that after an emeute lasting for weeks—with direct losses of millions from acts of violence and rapine, and incidental losses of millions more from suspension of wage earning, interruption of traffic, and interference with commerce, threatening starvation to whole communities and entailing destitution and misery upon thousands—the national police should finally appear, and taking stand on the ruins, amid the smoking desolation, command the disappearance of the rioters. It would be better if the ultimate hand of the law were raised at the first open act of defiance, and steadily and silently upheld in the face of impending riot, until the moral effect should have repressed the rising wave of violence, and given time for cooler counsels to prevail. . . . If the law in any of its practical effects shall involve injustice to or unnecessary hardship on any, let it be changed as shall seem best. The one principle that may not be changed is respect for and obedience to law so long as it is law. This principle is the deepest teaching of the military life, and can best be preserved and expanded by the retention of an adequate military nucleus as a permanent and wisely-regulated feature of the national life."

TWENTY-FOUR years ago electricity as a mechanical power was unknown. Now $900,000,000 is invested in various kinds of electrical machinery.

The Locomotive Fireman.

It is doubtful if there is a man on the train who is less appreciated than the fireman. The public shakes hands with the conductor who has charge of the train, thanks the brakeman for many little courtesies, bows to the baggage master who looks out for its luggage in transit, trusts its valuables with the express manager, and talks long and loud of the "brave engineer," but the fireman—he who bends to his work and feeds the fire that makes the steam—is never mentioned. Sometimes a purse is made up for the engineer. No one ever heard of the fireman getting a purse, but the records show that he has performed as many deeds of valor as the engineer. Again, if the train leaves the track or goes into another train, the fireman has fewer chances to escape than any man on the train, except, perhaps, the mail clerk, shut up like a rat in a cage.

When the fireman is at work, and that is nearly all the time when the wheels are turning, he stands stooped over, shoveling in the fuel or raking the coals in the fire box. His view ahead is obstructed, and he cannot see the danger that may be dashing upon him. The rattle and roar of the machinery may drown the engineer's warning call—a crash—the tender pins him to the boiler head, and he dies a horrible death.



THE TEXAS, SECOND CLASS BATTLE SHIP OF THE NEW NAVY—6,300 TONS DISPLACEMENT.

The records show that more firemen than engineers are killed in railroad wrecks. About the only time the fireman has a little leisure is when the train is running down grade. Then "she is shut off," steam is saved, and the knight of the shovel climbs up to a cushioned seat and takes a breathing spell. But even then one eye is ahead, his hand on the bell cord and the other eye fastened on the steam gauge.

There is a science in "feeding" an engine. There is a way to throw in the coal and to empty the shovel and close the furnace door at the same time. It requires nice calculation that tells how many "scoop-loads" are needed to send the hands on the gauge to the proper figure; deft handling to keep the deck of the cab clean, and other little things that go to make a skillful fireman.

In the old days the fireman on "wood burners" had a hard time of it, but he had a sinecure compared with the man in blue overalls and jumper who "stokes up" one of the huge "moguls" or "hogs" of the present day. These engines haul freight and eat up coal as if it were greased paper. The fireman is at work continuously, and about the only time he has to rest is when his train "takes a siding" to let another train pass, or a longer stop than usual is made at a station.—Com. Bulletin.

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THE BAR AND HORSESHOE IRON INDUSTRY.

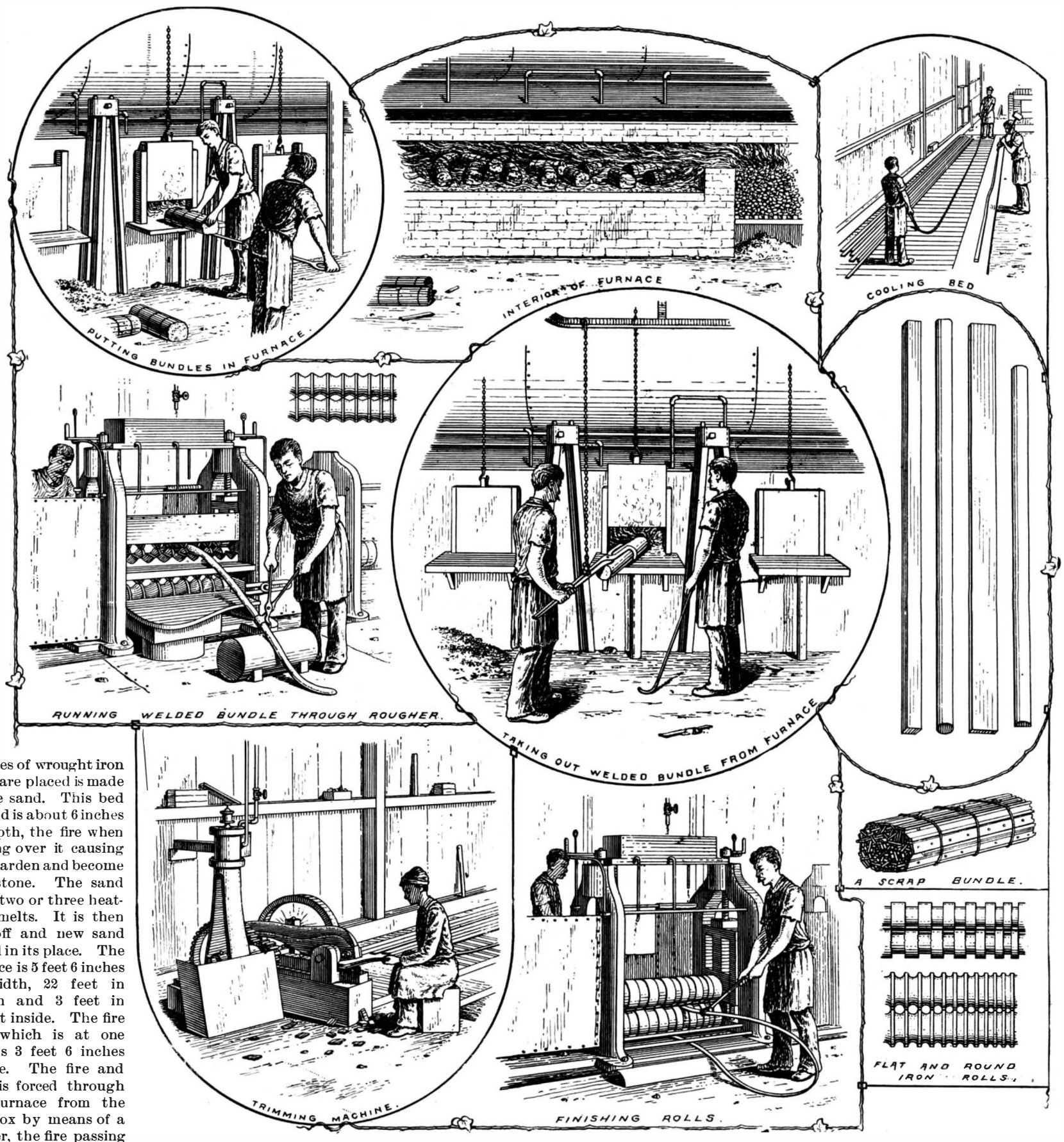
The bar, round, half round, and flat iron used by wheelwrights, horseshoeing establishments, etc., is made principally from wrought iron scraps. These scraps, consisting of old railings, tires, hinges, etc., are collected together by junkmen and sold to the manufacturers, who work the material over and turn it again into new iron. The scraps are first cut up into lengths and formed into bundles of 250 pounds each, the bundles being about 24 inches in length and about 8 inches in diameter. They are then placed into a furnace by means of long-handled iron peels or shovels by the attendants and left for the heat to weld the material together. The furnace is lined on the inside with fire brick. The bottom or flooring on which the bundles of wrought iron scrap are placed is made of fire sand. This bed of sand is about 6 inches in depth, the fire when passing over it causing it to harden and become like stone. The sand after two or three heatings melts. It is then run off and new sand added in its place. The furnace is 5 feet 6 inches in width, 22 feet in length and 3 feet in height inside. The fire box, which is at one end, is 3 feet 6 inches square. The fire and heat is forced through the furnace from the fire box by means of a blower, the fire passing through an opening built at the top the same width as the furnace and about 1 foot in height. The iron casing around the furnace is prevented from getting red hot by means of a 6 inch water jacket or reservoir which passes along the front and top of furnace, the cool stream of water passing through, keeping the temperature down so that the attendants can easily remove the bundles without burning themselves. The fire and heat, after passing through the furnace, is used also for heating the boiler. The boiler rests over the top of the furnace, the bottom and sides being incased in a brick-lined iron shell. The flames from the furnace are drawn through this casing and around the boiler and pass out into the chimney. About 50 or 60 of the bundles are placed in the furnace at a time, which after 30 minutes heating the pieces weld together in each bundle and each forms itself into a solid mass. When at a white heat they are removed from the furnace by means of a long pair of tongs which are attached to a trolley. They are then taken to what is called a rougher. The rougher contains three grooved rolls through which the welded bundle is passed back and forth to stretch it out into proper shape for the finishing machine. The roughing rolls are about 4 feet in length and about 1 foot in diameter and made of gun metal. The rolls contain different sized oval grooves, one being placed directly over the other. An operator puts one end of the bundle, which has been considerably reduced in size by the welding process, in one of the large grooves of the two bottom rolls, the revolving of which draws the iron through, which is immediately turned over by another attendant, who passes it back again through the top rolls.

Each time it passes through the machine the end is placed into a smaller groove. The rolls travel at the rate of 210 revolutions per minute. The billet is passed through the rougher about 12 times, which stretches it out about 10 or 12 feet in length, the operation taking but a few seconds. From the rougher the hot iron is passed over to the finishing machine. This machine contains two grooved rolls, one placed over the other. They are about 3 feet in length and about 1 foot in diameter. The grooves are square and also of different widths and depth. The collars of the top roll fit into the grooves of the bottom roll, and can be raised and lowered according to the thickness of the iron wanted. The operator with his tongs places the end of the piece of iron in one of the large grooves between the rolls, the revolving of which forces it through and also stretches it out into a flat shape.

The operator on the other side of the machine then passes it back again underneath to his partner, who turns it over and runs it back again through a smaller groove, stretching it out again. This operation is continued until the proper length is obtained. For round, half round, and bar iron the operation is about the same. The time consumed in running the iron through the rougher and finisher is about 50 seconds, the iron passing back and forth through the machines about 20 times. As the bar of red hot iron passes through the finishing machine a stream of cold water is allowed to run on it, which takes off the scales.

The bar of iron, which is about 45 feet in length, is then placed upon a cooling bed. This cooling bed is made of iron bars 4 feet in length, placed about 1 inch apart, underneath which is an air space about 4 feet square. The iron strips are left on this bed for about 25 minutes to cool and then taken and trimmed and cut up into proper lengths. Refined iron is heated over twice. The bundles are first welded in the furnace and run through a rougher and made into billets from 4 to 6 feet in length. They are then cut up into pieces of the right weight to make them the proper length and reheated and run through the machines again.

The billets are cut up into pieces weighing from 25 to 115 pounds each, the smallest pieces being formed into ½ inch round and the largest into 1 inch round iron, the flat iron in size from ¼×¾ inch upward. 65 men turn out about 60 tons of finished material weekly. The sketches were taken from the Standard Rolling Mill, New York City.



THE BAR AND HORSESHOE IRON INDUSTRY.

THE monument erected to Lincoln in Edinburgh is the only memorial of the kind in Europe.

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Parks and Park Planting.

If the word "park" in popular usage ever suggested a group of well defined ideas, it has in these later days lost its distinctiveness, so that to one man it may mean a country fair ground, and to another a forest, a game preserve, a field for athletic sports, a race track, an arboretum or a military parade ground; in fact, it is applied in a confused way to any space that is not roofed over.

This is a misfortune, for when we are discussing questions of park design or park maintenance, or inquiring what are the true functions of a park, or what should be excluded from it as destructive of its value, we must have a clear idea of what it is and what it is for. We have always used the word to indicate primarily a place where the mind and body are refreshed by rural scenery. Of course, a park will also furnish fresh air and sunshine, opportunities for bodily exercise and rest, but beyond these, and more important than these, is the refreshment of mind which comes from the influence of beautiful natural scenery. The paths and roads are not, therefore, merely places to walk in or drive over; their fundamental use is to make the scenery of the park available to persons on foot or in carriages or on horseback, so that they may find that relief and repose which natural beauty alone can bring to city-wearied senses.

The value of a city park, therefore, for a city population is greater or less, according as the poetic charm of its scenery is preserved and developed. It seems to be an admitted fact also that quiet, pastoral prospects have the greatest intrinsic value in enabling us to resist the wearing influence of city life and recover wasted mental energy, and it, therefore, follows that the best work is not one in which the architectural features predominate, or in which the planting aims to be highly ornamental or decorative. In a paper published during the past year at Vienna, called Der Park, by Franz Graf, there is an instructive discussion on the quality of landscape beauty required for a park, part of which will be found in a condensed form in the paragraphs which follow.

A park is more than mere woodland and field, but, on the other hand, it is not a garden in the narrow sense of the word. The designers of parks invariably fall into errors of disposition and treatment when they forget this distinction. A park is not a garden, although its mere extent is not the distinctive mark of the difference between the two. There are large gardens and there are small parks, and the purpose of both is to awaken pleasurable sensations. In achieving this end, however, a garden is treated like a miniature painting. Flowers and other materials which are in themselves minutely beautiful receive loving attention in every detail. Such a garden delights us with its color, enlivens us with its perfume, cools us with its shade, but here its service ends.

A park picture is drawn with a bolder hand, so that delicate work on details is dissipated and wasted. It must have something more than sensuous beauty—broader and grander features which make appeal through the imagination to the nobler faculties. Years ago our ancestors caught the right idea when, tired of the endless avenues and clipped trees of Lenotre, they began in an imitative way to make copies of nature in their English gardens by mingling grottoes and artificial ruins and brightly colored dairy buildings with their scenery. They aimed to simulate pastoral scenery, but they overshot the mark, forgetting that a park is not a mere imitation of woodland and field, any more than it is a series of formal flower beds.

Of course, a park must be beautiful, for if it does not speak to the eye like a picture, it will not appeal to the heart like a song; and if it shows no refinement of taste, it falls far below the rank of what a forest or meadow or a vineyard may happen to be.

It is a happy accident when a forest, which is treated in strict accordance with the forester's craft, chances also to be striking from a pictorial point of view, or when a meadow or vineyard, by reason of the fortunate dispositions of its hills and valleys, its foliage and its water, is beautiful as well as useful.

But the first purpose of a park is to secure these results which in the woods and the meadow are happy accidents. Not only is beauty essential to a park; its whole value lies in beauty. But it must be that serene and enduring beauty which is embodied in its essential and permanent features, and not merely the transient and superficial beauty of floral embroidery. It must have dignity of expression, and not mere prettiness.

Again, although a park must be beautiful, it may be bad art to crowd it full of plants and structures simply because they are beautiful. We too often see a huddle of expensive rarities which struggle with each other to reach the light, and yet leave no reposeful spot for the eye to rest upon. This is why stretches of turf and simple wood borders are more refreshing as a spectacle to the weary than any collection of oddities which excite the eye rather than rest it, by their glowing colors and conspicuous forms. This does not mean that a park should have no beauty of detail, but in the hand of an artist who wishes to produce an effect upon the imagination, a few beautiful things, harmoniously adjusted, mean more beauty for the whole than beautiful objects in such profusion that they cannot be grouped into any quiet and consistent picture. And since we aim at permanent beauty rather than any transient impression, this consideration alone explains why tender exotics, which seem to shudder in a cold climate, and imported novelties, which drag out a homesick life in exile, are not to be compared with native oaks and pines, which rejoice in the vigor of health, and grow more beautiful through years, and even through centuries.

This longevity of the noblest trees and their continued growth in dignity and beauty suggest the thought that one who creates a great park must plant for posterity. What is called planting for immediate effect is usually a makeshift, and, like other makeshifts, an expensive blunder.

Light is the life of plants, and as the whole plant is condemned to death if it gets no light, any part of it which the sunbeams no longer reach is doomed. The advice to set the sapling where it will have enough light whan it becomes a tree is simple, but it is constantly disregarded. Even if we are planting to exclude some disagreeable object from sight, it is better to set the trees so that they can have abundant room for their roots and light for their tops, even though during a few years we must wait patiently for the wall of foliage which is to do duty as a screen.

If we plant this screen thickly, the offensive object will be quickly hidden, but it will be only a short time before the lower branches give up their struggle for life, and there will remain a roof of foliage with bare trunks which hardly obstructs the view. A much more serious matter it is to destroy a good tree that is in the way. It requires firmness of purpose to destroy an object which is beautiful in itself, but it is much better to suffer a pang for such a loss than to have the lifelong vexation of knowing that a tree, though noble in itself, is out of harmony and proportion with its surroundings, or that it compels some inconvenient adjustment of walks or drives, and that it will keep on doing this forever. The proper way is to plan and plant for posterity, and even if the removal of a tree leaves a wound which can only be healed in fifty years, it should be remembered that the sapling planted near it will not only fill its place, but make a complete and satisfying picture which will give unalloyed delight for centuries.—Garden and Forest.

Phosphoric Acid in the Manufacture of Superphosphates.

Speaking of the development during the past few years of high-grade supers, Mr. Wyatt says these supers are made to contain about 45 per cent. of P_2O_5 in a "water" and "citrate" soluble form. The method employed in so doing is both scientific and rational, since it consists in supplanting the oil of vitriol usually used as a solvent for the raw phosphate with phosphoric acid itself.

In the manufacture of superphosphates as now carried out, the desired solubility, either in water or in citrate of ammonia is attained at the cost of doubling the bulk of the raw material by the addition of sulphuric acid, which practically serves no other purpose and has no other value than that of a solvent. If such raw material, therefore, contain 60 per cent of tricalcic phosphate, the "super" can only contain 30 per cent, and this, from the agricultural consumers' standpoint, is certainly an anomaly, and, apart from any question of solubility, must remain so for two reasons:

(1) A ton of 60 per cent phosphate of lime, finely ground, but insoluble in water or citrate of ammonia, can be purchased at some central point for say £2.

(2) A ton of superphosphate, containing only 30 per cent phosphate of lime, cannot be purchased at the same spot for less than £3.

In the one case, freight is paid upon only 40 per cent of waste material, whereas in the other it is paid upon 70 per cent of practically valueless matter.

That a legitimate profit should attach to the manipulation of an inert, and its transformation into an active body, is beyond question, but I cannot see why such enormous and unreasonable benefit should be derived from the trade in fertilizers by the railroad companies. If it were for no other object, therefore, than the reduction of such detrimental freight charges to a minimum limit, I think it is well worth while to consider briefly the practicability of superseding the old method of manufacture.

The reactions involved in the process of superphosphate mixing have served to demonstrate that the cheapest and best known method of making liquid phosphoric acid from calcic phosphates is by driving it from its combination with lime by means of the stronger oil of vitriol, and by utilizing many low-grade phosphates which now, for lack of a sufficiently cheap freight, have practically no market value.

PREPARATION OF THE LIQUID PHOSPHORIC ACID.

The only essential conditions to the manufacture are: (a) That the material used shall contain a minimum of carbonate of lime, in order that no unnecessary excess of the sulphuric acid be required for its decomposition. (b) That it shall contain as small a percentage as possible of any combination of iron and alumina, since both of these bodies contribute to the formation of a gelatinous mass that seriously interferes with the course of the operations.

If the exact chemical composition of the raw phosphate is known, the quantity of sulphuric acid necessary to insure the desired dissociation of all the phosphoric acid from the various bases present is very readily calculated.

The operations are conducted in large tanks made of suitable wood, lined with lead and provided with agitators. The required quantity of sulphuric acid, say, for example, 2,000 pounds of 50° B. strength (106° Tw.), is mixed in each tank with sufficient water to reduce it to a density of 14° B. (22° Tw.) The agitators being in active motion, a sufficient quantity, say 2,000 pounds, of finely ground phosphate is slowly added to each tank, and stirring is continued for five hours, open steam being occasionally blown in by an injector through the side of the tank in order to keep the mixture quite hot.

When the five hours have expired, the cream from each tank is run off into filters made from large wooden vessels lined with lead and provided with false bottoms, where the hydrated sulphate of lime separates from the solution of phosphoric acid. The latter passes through the filter as a bright straw-colored fluid, of a gravity which, commencing at about 12° B. (18° Tw.), gradually becomes reduced by careful washing to 1° B.

The exercise of ordinary care and precautions prevents all cracks from being formed on the surface of the gypsum contained in the filters, and the lixiviation of the mass is stopped directly the gravity of the filtrate reaches 1° B. The hydrated sulphate of lime is now raked together into the center of the filters to drain, and is finally carried to the dump, while the last runnings from the filters, which are too weak for economical concentration, are used to dilute the strong sulphuric acid required for subsequent operations.

The filtered phosphoric acid liquor is pumped into an elevated tank, and thence it runs by gravitation to a series of leaden evaporators of any convenient form of construction, heated either by direct fire from the top or from the bottom, or by waste steam from boilers.

During the progress of the evaporation the acid solution practically deposits all its sulphate of lime, and it finally attains a density of about 44° B. (91° Tw.) At this strength it should contain about 45 per cent of phosphoric anhydride, with only a mere trace of lime, magnesia and iron and alumina, and is now ready for use in place of sulphuric acid in the manufacture of soluble and assimilable phosphates.

USE IN MANUFACTURE OF SUPERS.

Its mixture with the raw phosphate can be effected in the usual superphosphate mixers, on the same system of calculation and by the same method of manipulation as are now used with oil of vitriol, and it very soon sets into a porous mass, which, although not very dry, is sufficiently stiff to be easily dug out. This mass is cut up into pieces of reasonable size and dried by hot air in any form of shed that will facilitate effective and rapid work. Directly it is sufficiently dry for the market, it is put through a disintegrator and filled into bags.

If you will compare this material with the present staple superphosphate, which barely contains the equivalent of 30 per cent of bone phosphate of lime made soluble, you will find that, in addition to its lower manufacturing cost, it contains the equivalent of 99 per cent, or more than three times as much bone phosphate of lime, made equally as soluble and available. It could, therefore, be distributed at an economy of two-thirds of the freight now actually paid for useless material, and you will agree with me that this is a consideration of the highest consequence, seeing that the world must have phosphate, and that the raw materal, while it is of the best quality known, is confined to an area somewhat remote from the large mass of consumers.—Chem. Tr. Jour.

The Ship Canal to the Lakes Again.

A bill has been introduced in the Senate authorizing the President to appoint three persons to confer with any similar committee appointed by Great Britain or Canada, and report as to the feasibility of a canal for ocean vessels between the Atlantic and the lakes; where it can be most conveniently located; the probable cost, with estimates in detail; and if any part of the canal should be built in Canada, what arrangements are necessary to preserve it for use to the people of this country. All the necessary facts relating to the construction and use of such deep water channel are also to be reported on, and it is proposed to appropriate $10,000, or so much thereof as may be necessary for actual traveling and other necessary expenses, the members of the commission to serve without pay.

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Storm Window for Locomotive Cabs.

The Tinker Storm Window Company, of Springfield, Mass., are manufacturing a window for locomotive cabs on which frost will not form and obstruct the engineer's view. To the inside of a regular cab door is secured a specially designed window so constructed as to form a watertight space about five-eighths inch in width between the two panes of glass, which space is filled with water, or, if preferred, any other suitable transparent liquid. The water is heated sufficiently so that the snow, ice, frost, etc., will not adhere to the surface of the glass, thus providing a clear glass in front of the engineer during the worst storm or coldest weather. The necessary warmth is imparted to the water by a tube between the glasses, through which a small jet of steam passes.

When filled with water the appearance of the window does not differ from a single pane of plate glass. It is claimed to be easily regulated by the engineer, to require but little steam, and to accomplish its work in a most satisfactory manner.

A New Method of Preparing Diastase.

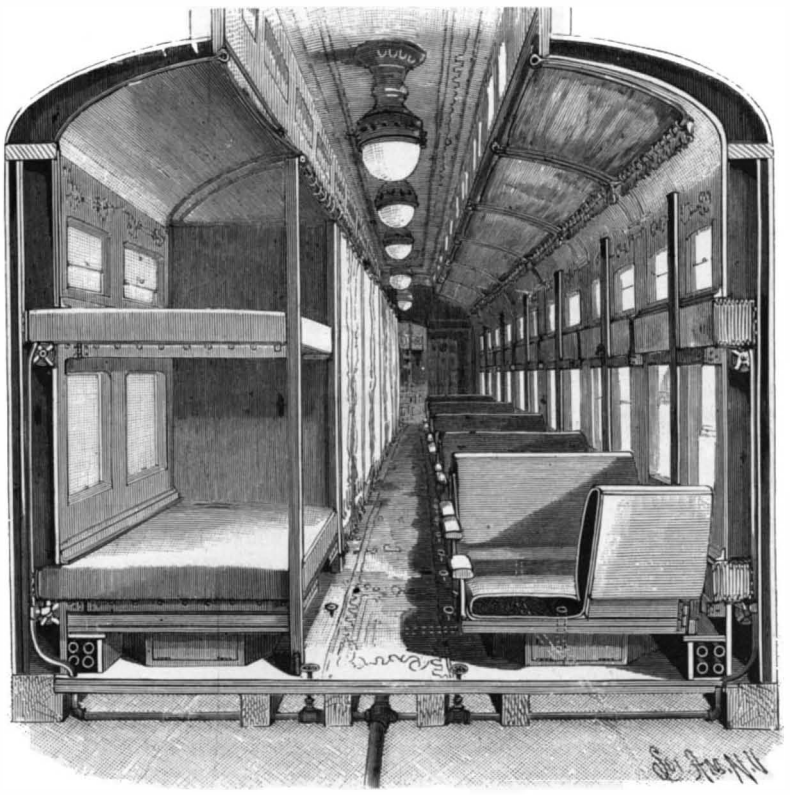
A new method of preparing diastase, the ferment which produces malting, has recently been discovered by Jokichi Tokamine, a Japanese who has studied in the universities of Glasgow and Tokio.

By cultivating a mushroom growth, Eurotium oryzae, on wheat bran he has found that at an early stage it bears on its roots minute crystals of diastase, while the unripe spores contain a powerful ferment. Diastase of sufficient commercial purity was obtained in considerable quantities by washing the bran and crystallizing the diastase from the solution. A mixture of equal parts of this diastase and crude wheat bran added in the proportion of 10 per cent of the grain mashed will produce, it is said, a more perfect conversion than 10 per cent of the best malt. The wheat bran after the fungus has been grown may be used for cattle feed. The ferment will continue to produce fermentation in a sugar solution until nearly 20 per cent of alcohol is present.

PNEUMATIC BERTHS AND CUSHIONS IN PARLOR CARS.

According to the improvement forming the subject of the accompanying illustration, the cushions for the seats, as well as the bed or mattress, in a combined sleeping and parlor car, are connected with the compressed air pipes of the train, and adapted to be inflated by opening suitable valves in connecting pipes, or be collapsed and compactly stored, according to the daily or nightly requirements in such service.

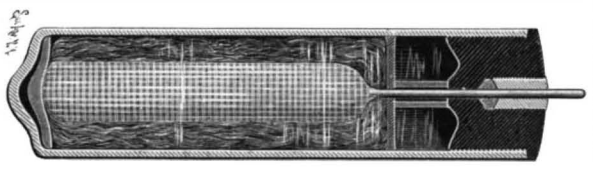
A patent for this invention has been recently issued to Mr. Linford F. Ruth, of Connellsville, Pa. The mattresses or bed cushions, and also the chair cushions, are simply air-tight bags of soft rubber or other suitable material, and from a main compressed air pipe running centrally under the floor three branch pipes lead to them in each car section, one of the branches supplying air to the two chairs and the other two branches supplying air to the upper and lower berth mattresses respectively. In each branch is a three-way cock for admitting or cutting off the air supply, and opening a vent or discharge. The mattress or berth cushion is creased to fold like an accordion, and is attached at the head and foot to a flexible strip winding upon the barrel of a spring, whereby it is drawn in collapsed condition into a covering or casing at the side of the car when not in use. To guide it to position and support it when extended, it has hooks which catch over transverse steel frame supports, connected at right angles to vertical standards adapted to fold flat against the side of the car. The entrance of the air causes the inflation and extension of the mattress, which at its outer edge is connected to a panel rail moving in and out with it, and on turning the valve to discharge the air, the mattress is drawn back in folded position by the tension of the spring. Each section has a base compartment under each seat for blankets, bed linen, etc., and the chair swivels on the base about the compressed air inlet pipe, the chair back frame folding forward when the cushions are collapsed. The cushions are distended or collapsed by the adjustment of the valves in the same manner as the mattresses are. The sections are separated by curtains arranged on vertical spring rollers, and the curtains that close in the sections from the aisle hang from a rod held by arms to rock in such way that the curtains may be swung back against the ceiling, as shown at the right in the illustration. This improvement is designed to not only save time and trouble in adapting any portion of the car to either use, as required, but is also calculated to render the car much more sanitary and comfortable.



RUTH'S COMBINED SLEEPING AND PARLOR CAR.

A COMPACT BATTERY.

In some things bigness is a valuable feature, in others, smallness is a desideratum. In the case of the battery herein illustrated, full size, we have what is probably the smallest, lightest, and most compact practicable battery made, while it yields a large current (2 amperes) at a reasonably high voltage (1·1 volts). It will thus be seen that while this battery is at one extreme in point of size, it is at the other extreme as regards the work it can do. It is capable of ringing a door bell for twenty-eight hours continuously, equal to about one and a half years in ordinary use. It will work a Faradic motor from 52 to 100 continuous hours, and 2 cells on a sparking coil in a gas light will



CAPO-FARAD BATTERY (FULL SIZE).

give nearly 360,000 ignitions. For testing and blasting it is found to be very efficient and convenient.

The battery consists of a zinc cell $\frac{11}{16}$ inch in diameter and 2¾ inches long, closed with a hard rubber stopper, and containing an electrode formed of fused silver chloride. The chloride is cast upon a zigzag silver wire, the straight end of which extends through a stuffing box in the cover, forming one pole of the battery. The zinc cylinder forms the other pole. The cylinder of fused chloride of silver is inclosed in a covering of textile material, and held in place by hard rubber disks at opposite ends. The disk adjoining the hard rubber stopper is held in place by a short piece of elastic tubing surrounding the silver wire. The space between the silver chloride and the zinc is filled with fibrous material which is saturated with the electrolytic liquid with which the cell is filled.

For many purposes where this battery is to be carried in the pocket, it is inclosed in a casing containing two, four, eight or more cells. A four-cell battery with casing weighs but five ounces.

These batteries are used in the Treasury Department and in other places in connection with small electric lamps for temporarily illuminating vaults, safes, etc. A single cell of this battery is so light that it may be mailed for two cents. It will work in any position, does not polarize, is not affected by climate, and the strength remains constant up to the moment of its final exhaustion.

Mr. James J. Pearson, manager of the Nassau Electrical Company, of 108 Liberty Street, N. Y., after a long series of experiments, has brought the Capo-Farad battery to its present state of perfection.

Work on an Ostrich Farm.

The ostrich farms of South Africa are very curious and interesting places. The equipments are generally very simple and inexpensive and the crop is found to be very profitable. The first requirement of an ostrich farm is a "camp" or pasture for the birds, and these vary in size from 3,000 to 8,000 acres. Such a camp generally holds comfortably about 300 ostriches. The camp must always be good pasture ground, and here the birds remain for the entire year, except when they are brought together once every four months to be plucked.

The ostrich builds its nest in the sand in a very careless fashion and here it lays its eggs. The nest is crudely constructed, consisting simply of a round hollow carved out in the sand. Sometimes the female bird scratches this hole or nest, but the nest is generally formed by the birds having set continuously upon one spot for a long time. One bird will lay from ten to twenty eggs, but often three or four birds will lay in the same nest. Often there will be as many as seventy or eighty eggs in a single nest. In this case most of the eggs are taken out, since an ostrich cannot cover more than sixteen eggs. About forty-four days are required for hatching, and when a nest is hatched the little birds are brought under cover and fed. They are usually fed both morning and evening on barley or rape.

When the time comes to pluck the birds, the real work on an ostrich farm begins. They are usually rounded up by a number of men on horseback. At first they are very fierce, but when all are huddled together in a kraal every bird becomes docile and manageable. The birds are taken one at a time and a bag or stocking is placed over its head. It is then quickly clipped by two skilled attendants. The prime feathers are usually plucked in June. Prime feathers are the long white fancy feathers, and they number from eighteen to twenty on each wing. Four months after this picking the stumps of these feathers are drawn out, and two months after this the "primes" or short black tail feathers are taken out. The general rule in plucking is to obtain as many feathers as possible without injuring the ostrich or robbing the bird of a suitable winter coat.

The Cooper's Hawk.

Mr. Chas. B. Cook, writing to the Country Gentleman, says the Cooper's hawk so closely resembles the pigeon or sharp-shinned hawk that the two species may be economically treated together. The following description will apply to both species: Upper parts of the head, brownish black; back, bluish gray, with the upper side of the tail crossed by black bands; the lower portions white, with breast and sides marked with bars of red. The length of the Cooper's hawk varies from 16 to 20 inches; extent about 30. The sharp-shinned hawk measures about six inches less.

Both these species are very abundant over the greater part of North America. They are the hawks that are distinctively chicken hawks, and mostly responsible for the reputation that has been falsely conferred upon the beneficial species.

On the wing, these hawks may be distinguished from the beneficial sorts by their nervous, rapid and irregular flight. They have the habit of flying low, and are rarely seen soaring in the sky like their larger cousins. The subsist in the main on a bird diet, but occasionally insects and even small quadrupeds are consumed.

In some parts of the northwest the Cooper's hawk has earned a good reputation, but over the greater part of its range it is a terror to bird and fowl alike. Even the swift-flying partridge or grouse, fully aware of its enemy's presence, must be in a dense thicket to stand any chance of escape, and even then an escape is due to a timely drop into some brush pile, where its protective color and motionless form come to the rescue. When a sharp-shinned or Cooper's hawk attacks a flock of poultry, its visits are likely to be continued indefinitely. Dr. Warren states, in Fisher's Hawks and Owls of the United States, p. 38, that one pair "destroyed some fifty chickens from one farm, twelve of which were taken in a single day."

The sharp-shinned hawk is very fond of pigeons and often works fearful havoc among some fanciers' dovecotes. A few years ago the writer was watching a flock of doves feeding near, when a sharp-shinned hawk swooped down on one of them, but missed his bird, as the pigeon fairly brushed him off in flying through the lowest space in a board fence. The hawk followed, passing through the next space above, but evidently out of respect for the pigeon's presence of mind, he ceased pursuit and quietly fluttered off toward the woods.

Both the above species at times are exceedingly bold, and seem to depend on their rapid wings to carry them off in safety. A few years ago one was known to attack the person of Mr. C. D. Walcott, in Lewis County, New York. The bird continued the assault for some time before it was dealt a fatal blow with a hammer.

These birds' bad habits incidentally turn them to good in the case of the English sparrow. In cold weather, when most native birds have gone south and the barnyard fowls are in winter quarters, the English sparrows furnish a constant supply of food. This trait, coupled with their insect-eating habits, shows us that there is some utility even among the most fierce and relentless of the feathered tribes.

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RECENTLY PATENTED INVENTIONS.

Engineering.

ENGINE AND SUPERHEATER.—James C. Walker, Waco, Texas. This invention comprises a superheater apparatus and engine driven by it, which in turn is utilized to automatically shift the steam-heating and cutoff devices, the mechanism requiring but a minimum of power to move the piston, there being also provided a primary heating or steam-producing means arranged to sift the steam of all solid particles of water. It is preferred to combine the use of this improvement with a rotary engine, such as formerly patented by the same inventor, and means are provided to retain the heat within the several steam-holding compartments or reservoirs, to utilize as far as possible its superheated energy.

VALVE.—Thomas P. Ford, Brooklyn, N. Y. This is a combined regulating device and mechanism for controlling it primarily designed for controlling the draught under a boiler, to regulate the steam pressure, being also applicable to various other uses. The invention relates to valves forming the subject of two former patents issued to the same inventor, the present improvements being designed to promote a very sensitive action of the valve on the slightest variation of the fluid pressure.

Railway Appliances.

SWITCH.—John W. Umscheid and Charles H. Klute, Union Hill, N. J. These inventors have devised a switch and switch-working mechanism which may be conveniently operated from a passing train. Combined with the switch points are pivoted levers, there being connections between the levers and the points and swinging arms for engaging the levers. The working mechanism may be operatively connected to turn a number of switch points, turning either switch point at the discrimination of the operator on the train, the mechanism not being liable to become inoperative or be clogged.

REFRIGERATOR CAR.—Charles S. Hardy, San Diego, Cal. According to this invention an apparatus is provided for refrigeration and storage, comprising a folding ice box to which is hinged a drain flue section with drip guards, the ice box sections being adapted to open outward to position for use, and having locking devices to prevent the collapsing or folding of the box by external pressure. The invention affords simple means to prevent shifting cargoes from closing in the folding sections of the ice box, and also operates to support the folding side section while the floor section is being raised, the drain passage also being of novel construction.

CAR COUPLING.—Levi L. Freeman, Broadlands, Ill. This is a coupling of the automatic latching type, in which an arrow-headed link bar is employed to connect two drawheads, by which the cars will be automatically coupled and may be quickly uncoupled from either side of the car. In a forwardly recessed, oppositely slotted drawhead, are pivoted spring-pressed latch plates vibratile in the slots, side rods being adapted to swing the latch plates outwardly.

CAR COUPLING.—James W. Elliott, Galveston, Texas. In the middle line of the drawbar of this coupling is a vertical slot in which is pivoted a coupling latch, the hook of which reaches to just within the flaring mouth of the drawhead. At the rear end of the latch there is an eccentric upon a horizontal shaft, there being crank arms adjustably connected with the ends of the shaft, by which the latch may be adjusted to engage entering links from cars of different heights. With this improvement a whole train of cars may be coupled by one backing movement of the engine, the brakeman having previously passed down the line and set all the cranks.

ILLUMINATED STREET CAR SIGNS.—William H. Carroll, Jersey City, N. J. This inventor has designed an improvement whereby one may readily distinguish a car of a certain line at night, preventing passengers boarding the wrong car at night. The invention consists of an illuminated sign, in connection with a small lamp and reflector, to be arranged on the car roof, the sign bearing the distinctive title of the route the car passes over, the whole arrangement being quite simple and inexpensive.

Mining, Etc.

AMALGAMATOR.—Lewis D. Coe, Leadville, Col. The mercury well of this apparatus has an outlet channel, and there is a chute above the well with a valved opening in its bottom, a supply pipe leading from the opening in the bottom of the chute to the mercury well near its bottom, the inner end of the supply pipe projecting a short distance into the well and being covered by a screen. The apparatus is designed to save all the precious metals and to permit of conducting the operation without interruption.

COAL WASHER AND SEPARATOR.—Thomas M. Righter, Mount Carmel, Pa. This is a machine for washing coal and separating it from the slate, dirt and other refuse. The entire operation of washing and separating is carried on under water, there being provided convenient means of discharging the refuse and coal at different points, and the work being done very rapidly and cheaply.

Mechanical.

SECTIONAL WHEEL.—Perry H. Williams, Memphis, Tenn. This is a simply and strongly made wheel which may be attached to a shaft without removing the latter from its bearings. It is made in two half sections, each having a broken rim and sectional hub, the sections being united on the shaft by slotted lugs, flanges and bolts.

BEAM FLANGE PUNCH.—Robert H. Ireland, New York City. Two tables, at spaced distances apart, receive the web of the beam, according to this invention, die plates being mounted on the tables adjustably by a screw-threaded shaft to accommodate different thicknesses of the web, the punching mechanisms being arranged over each die plate, and being adjusted simultaneously with the die blocks in a convenient and expeditious manner.

MOTOR CHARGING DEVICE.—James T. F. Conti, Paris, France. This invention provides means for automatically charging the reservoirs of cars propelled by compound air or other fluid, at certain points of their travel. The motive fluid is supplied through a main pipe, with branch pipes leading to the points at which connection is made with the reservoir on the vehicle, the delivery nozzle rising as the vehicle passes, the charging nozzles having a vertical and a lateral rocking movement, a piston valve controlling the admission of the fluid to the nozzle, a cock controlling the admission of the fluid to the chamber of the piston valve, while a trip actuated by the vehicle operates the cock.

WIRE GLASS MACHINE.—Francis M. Ryon, Streator, Ill. This is a machine to embed wire netting in rolled plate glass, and is intended for use in connection with tables for rolling rough or ribbed plate glass. With this machine it is not necessary to provide heat for the tables or rollers, other than that imparted by the molten glass while the sheets are being rolled, it being necessary on the other hand to apply cold water to the table plate and roller at more or less frequent intervals. Less power is also required and a smoother finish given.

Agricultural.

CULTIVATOR.—Benjamin M. Rolph, Dixon, Ill. This invention relates especially to disk cultivators, providing adjustible connections whereby disks may be set to run readily in ground that may be very hard, and for overcoming the difficulty heretofore experienced of shifting them in the cultivation of crooked rows. Two disks are, in this cultivator, owing to their adjustment, made to do the service of two gangs, lessening the weight required for their operation, and the arrangement is such that the disks will not clog up in wet ground, while the machine may be readily converted into a shovel plow.

BALING PRESS.—Hezekiah Bailey, Willamina, Oregon. This press is especially designed to form a valuable adjunct to a thrashing machine, baling the straw as fast as delivered from the thrasher, and thus receiving a continuous volume of material in the feed chamber. Its construction is such that a bale is formed at opposite ends of the press by the alternate strokes of the follower, there being opposite press chambers and an intermediate receiving chamber fed by the feed belts.

Miscellaneous.

RAISING SUNKEN VESSELS.—William A. and Fred E. Turner, Malden, Mass. According to this invention a series of air receptacles is to be connected with the deck or outside of the vessel, the receptacles being inclosed by an exterior netting, and attached to a chain to be passed around the vessel. In each receptacle is an air inlet, the several inlets to be connected with an air pipe leading to a tug, air being thence pumped to fill the several receptacles, after they have been placed in position by divers or otherwise, until sufficient air pressure is obtained to raise the vessel.

CAN SOLDERING AND TESTING.—Noah L. Bishop, Wassaic, N. Y. In a plant devised by this inventor a series of machines is so connected that a can, partially formed, and entered at one end, is automatically carried through the various machines and delivered from the final one completely finished and labeled if desired. The invention also provides an initial feed device, supplying the cans to the final soldering machine, and not liable to clog, though having many branches, there being novel connections between the several machines, and the soldered cans being thoroughly and efficiently cleaned while passing from one machine to another.

WHEELED SCRAPER.—Cary S. Heath, Montrose, Col. For excavating and leveling, this machine is arranged to permit the operator readily to adjust the scraper blade according to the material to be treated or the depth of cut to be made. The driver's weight presses the scraper into the ground, in operation, and when the blade is sufficiently loaded with scraped-up earth, it is lifted out of the ground and the load dumped by the rising of the driver from his seat. The operator stands on the platform when moving the machine from place to place to hold the scraper blade off the road. A special attachment, with spring cultivator teeth, is provided for orchard work.

CYCLE WHEEL.—Samuel A. Donnelly, Chicago, Ill. This inventor has devised a simply and strongly made wheel hub, of tubular body section, there being riveted to each outer end of the tube a flange whose perpendicular part connects with the spokes, while its horizontal part embraces and closely fits and reinforces the end of the tube, where it receives the internal ball-bearing cases, the inner ends of the rivets fastening the flange to the tube forming stops for the ball-bearing cases. The sprocket wheel is secured by bolts to one of the flanges connecting with the spokes.

BOOKKEEPING APPARATUS.—Georg Gercke, Jr., Hamburg, Germany. In accordance with this invention two boards or plates are employed, with metal bands, hinged clips, and a cutting apparatus, whereby loose leaves or sheets may be used in making daybook entries, in registered order, for convenient addition, checking and copying, before the accounts are transcribed to the ledger, the sheets afterward affording coupons to be kept and classified after any necessary ultimate reference.

LAWS OF GRAVITY AND MECHANICS.—Justin S. Hemenway, River Falls, Wis. This inventor has devised a simple apparatus for demonstrating the laws of falling bodies and some of the laws of mechanics, the apparatus comprising a suitable frame with graduated upright, there being journaled in the frame a horizontal shaft with which is connected a cord to which a weight is attached, there being a toothed wheel on the shaft and a detent for arresting the rotation of the wheel. A pendulum is also suspended from the frame, with its axis of motion axially in line with the shaft, there being independent detents to act on the toothed wheel and in operative relation with the pendulum.

LEVELING INSTRUMENT.—Erasmus F. Hargrett, Boston, Ga. According to this invention a level bar is hinged to one end and a graduated arm pivoted to the other end of a base bar, there being an index on the level bar, and the bail or handle secured to the base bar having a curved arm provided with a guideway concentric with the hinge. A fastening device secured to the level bar is made to engage the guideway of the handle. The instrument is designed to facilitate indicating the proper side slope of roads, ditches, etc., for plumbing or setting posts at any inclination, or cutting posts or bevels on bridges.

FAN.—George H. Newton, Monson, Mass. To permit the occupant of a chair to conveniently fan himself by a slight continuous tilting motion of an ordinary arm chair, or by rocking gently in a rocker, this simple and inexpensive device has been devised. A standard carrying at its top fan wings is screw-threaded at about the height of the chair arm, and this screw-threaded portion of the standard is engaged by a loosely sliding nut forming a portion of the outer end of an articulated arm which is attached at its other end to the chair arm.

GATE LATCH.—William F. Wilson, Cookstown, Pa. According to this improvement the locking latch can be readily adjusted at all times in relation to the keeper in case the gate sags, and without removing the entire latch frame. The latch turns on a bolt fitted for up and down movement and adjustment in the frame plate, the bolt being fastened in desired position by a wing nut.

FIRE ESCAPE.—Henry Vieregg, Grand Island, Neb. This is an improvement upon a formerly patented invention of the same inventor, the improvement especially consisting of a brake automatically controlled through a governor, whereby the rapidity of descent will always be kept within a safe limit, an auxiliary brake being also provided in connection with the automatic brake.

FIRE EXTINGUISHER VALVE.—Henry P. Amos, Chicago, Ill. This is a valve which is automatic in operation, and is designed not to be affected by increase in the water pressure. It has a stem comprising two parts which normally align to hold the valve to its seat, a pressure device forcing the joint in one direction to bring the stem sections in alignment, while a spring acts in the opposite direction to assist in bringing the stem sections out of alignment.

SASH FASTENER.—John B. Lashbrook, Oxford, Neb. This is a simple, inexpensive and reliable device, adapted for use on buildings or passenger cars, making a dust proof lock of the sash joints. The improvement comprises a serrated keeper strip along one side edge of the sash and fast on the casement, a serrated locking strip engaging the teeth of the keeper strip with its reversed sloped teeth, and adapted to bind one sash when slid on the keeper strip, while there is a device to slide the locking strip.

GUTTER ATTACHMENT.—George Andrews, Bellows Falls, Vt. To prevent damage from ice and snow to the gutters and spouts on buildings, this inventor has devised a simple attachment by means of which the gutter may be tipped up beneath the eaves, and the spout also turned beneath the eaves of a building, so that neither will collect snow, ice, or other matter, while in case of rain the spout and gutter are both turned back to position.

SUPPORT FOR MOPS, BROOMS, ETC.—Henry H Holmes, Council Bluffs, Iowa. This holder, which may be conveniently secured to a wall or elsewhere, for holding a broom, mop, etc., ready for use, consists of a bell-shaped case, with a passage for the handle. Adjacent to the passage is a rubber abutment, against which the handle is pressed by a flexible tip on the inner end of a spring lever oppositely fulcrumed, the broom being released by pressing on the outer end of the lever.

DESIGN FOR SASH FASTENER FRAME.—William D. Wilkinson, Toronto, Canada. From a flat base there rise plane parallel sides presenting separate spaced figures at the front and top, the sides being cut away obliquely on their rear edge from near the base to the top

NOTE.—Copies of any of the above patents will be furnished by Munn & Co., for 25 cents each. Please send name of the patentee, title of invention, and date of this paper.

NEW BOOKS AND PUBLICATIONS.

A FROGLAND WEDDING. Words and illustrations by Roy Conger. Music by Helen Hitchcock. Chicago: Laird & Lee. Price boards 50 cents, holiday binding $1.

THE CENTURY CYCLOPEDIA OF NAMES. A pronouncing and etymological dictionary of names in geography, biography, mythology, history, ethnology, art, archæology, fiction, etc. Edited by Benjamin E. Smith. New York: The Century Company. Pp. vii, 1085. Price, cloth, $10; full sheep, $15.

This superb work is a supplement to the Century Dictionary and must be considered as such in all criticisms. It contains biographical notices, historical facts, literary tities, descriptions of books, and a vast amount of other encyclopedic information which properly was not put into the Century Dictionary. In this sense it is a supplement of the dictionary, because in many cases what seem to be omissions in it will be found treated in the five volumes that preceded it. For instance, under "pons" the cyclopedia does not give the familiar "pons asinorum," which might seem to be an omisson, but on turning to the Century Dictionary we there find the subject treated fully. The general make-up resembles that of the Century Dictionary, the page matter being contained in three columns. It would be easy enough to find omissions, and we have, naturally enough, found several, but it hardly seems necessary for us to give them, as the book is one of genuine merit and deserves the warm praise of all. Its biographies are pre-eminently satisfactory, for although we have termed them biographical notices, they are so condensed as really to give a full account of the leading points in the lives of their subjects.

RADIANT SUNS. A sequel to "Sun, Moon and Stars." By Agnes Giberne. With a preface by Mrs. Huggins and many illustrations. New York: Macmillan & Company. 1894. Pp. xi, 328. Price $1.75.

This beautifully illustrated book by Miss Giberne, with a preface by Mrs. Huggins, is a testimony of what women can do in the higher fields of learning. There seems to be something in astronomy and in the higher mathematics especially congenial to the female mind. This elegant work forms most interesting reading. We would, however, have recommended the authoress, before writing the story of Galileo, to have read the admirable monograph on this great investigator published in the ninth edition of the Encyclopedia Britannica, in which are brought out the very curious errors perpetrated by him in astronomy, and the curious and false bases he selected in his upholding of the Copernican system, something far too little appreciated, the tendency of the day being to uphold Galileo as one of the early provers of the true theory of the earth's motion, whereas he rather figured as the reverse in attempting to uphold it on false proofs. One of the very interesting illustrations is a reproduction of a photograph of Dr. Huggins, which was taken by his wife. Dr. Huggins' new spectroscope forms the background for this picture.

THE INTERNATIONAL ANNUAL OF ANTHONY'S PHOTOGRAPHIC BULLETIN. Edited by Frederick J. Harrison. New York: E. & H. T. Anthony Company. Vol. VII. 1895. Pp. 352. Price $1.25 cloth.

A beautifully printed annual on photography, containing 21 full page illustrations, and a great variety of articles on all sorts of subjects relating to photography, besides numerous formulæ. We note an interesting illustrated scientific article on the timing of shutters, by James E. Boyd and Thomas E. French, of Ohio State University, a subject more apropos to hand cameras, where the speed of the shutter should be known. Charles Richard Dodge describes how to photograph by gas light. Harry W. Smith explains a novel method of making flash light silhouettes. There are also useful hints on the new printing process, a method of making collotype or photogravure prints at home, considerable information on lantern slide making, and descriptions of the best methods of development, especially with the new agent metol. The comparative illustrations of telephoto work by Professor D. L. Elmendorf demonstrate the great value of this new form of lens. Dr. Hugo Schroeder gives a few historical notes and a brief account of the recent improvements in photo lenses. It will be found to be a very readable book; the articles are short and interesting. It should be on the table or shelf of every photographer.

POPULAR ENGINEERING. Being interesting and instructive examples in civil, mechanical, electrical, chemical, mining, military, and naval engineering graphically and plainly described and specially written for those about to enter the engineering profession and the scientific amateur, with chapters on perpetual motion and engineering schools and colleges. By F. Dye. London: E. & F. N. Spon. New York: Spon & Chamberlain. 1895. Pp. viii, 496. Price $3.

The title of this book describes precisely its contents. It is a thoroughly practical work, treating of all sorts of practical scientific work, from chemistry, civil and mechanical engineering to shipbuilding. The illustrations are very numerous, not always of the finest quality, but graphic and attractive, and we believe that the work will be found a decidedly popular and useful one. We notice reproduced in it matter familiar to our readers. We may pass without notice its minor inaccuracies. Some details of the ancient history of engineering—for the work of seventy years ago is ancient history—are especially interesting. The section of perpetual motion might be commended to dreamers of the present day.

THE AERONAUTICAL ANNUAL. 1895. Edited by James Means. Boston, Mass.: W. B. Clarke & Co. No. 1. Pp. 171. Price $1.

Mr. Means is himself an investigator of aeroplane soaring, and this annual is devoted largely to old-time records of attempts to fly. Curiously enough, comparatively little is said about Lilienthal, Maxim, and Langley, for a very large portion of the book is devoted to antiques and the publications of the early part of the century. The utmost, then, that we can assume this annual to be, is an introductory number of a series which may eventually reach a point where the annual issues will represent the work of the present day. If the publication is continued, we see no reason why it should not do so next year.

THE BRITISH JOURNAL PHOTOGRAPHIC ALMANAC FOR 1895. Edited by J. Traill Taylor. London: Henry Greenwood & Co., 2 York Street, Covent Garden. 1894. 16mo. Pp. 1344. Cloth and paper. Price 50 and 75 cents.

The British Journal Almanac is always a welcome visitor, both on account of the excellence of the articles which have been contributed and the valuable formulas which have for many years formed one of the features of the book. The large size of the volume is owing to the number of advertisements, which occupy 850 of the 1344 pages. It would be a mistake to suppose that these advertisements are without interest. All of the latest apparatus and materials for all branches of photography and photo-mechanical printing processes are described. It is unfortunate the publishers should have adopted a continuous pagination for reading matter and advertisements. The samples of work given do not com-

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pare favorably with those of the American annuals. In the introduction the editor has summarized the progress of the year in saying: "If the year just closing has not been remarkable for the introduction of any new photographic process of cardinal importance, steady progress and improvement in most branches has still to be recorded."

PUBLICATIONS OF THE LICK OBSERVATORY OF THE UNIVERSITY OF CALIFORNIA. Vol. III. 1894. Sacramento: State Office. 1894. Pp. 229.

This report contains not only the purely astronomical work, but also papers treating of apparatus and materials. It will be a sine qua non in every astronomical library but it is also of interest to all cultured readers. The moon supplies a great part of the text, and a most superb series of plates from negatives taken at the observatory illustrate the contour of the lunar surface.

THE REPAIR AND MAINTENANCE OF MACHINERY. By Thomas Walter Barber. With about 400 illustrations. London: E. & F. N. Spon. New York: Spon & Chamberlain. 1895. Pp. x, 466. Price $3.50.

This practical work seems to really cover, to a certain extent, a new field, relating as it does to the repairing of broken parts of machines. The book is excellently printed and contains a very full text, and it is impossible to believe that it does not fill a most excellent field, and it will doubtless be very acceptable to the practical machinist in this country. It is elaborately illustrated and contains a good index.

THE MECHANISM OF WEAVING. By T. W. Fox. London and New York: Macmillan & Co. 1894. Pp. xx, 472. Price $2.50.

This work naturally does not lend itself to review. It is enough to say that it appears to embody an elaborate treatment of the subject, with numerous illustrations and full and satisfactory index. In its make-up it is worthy of all commendation; the illustrations are particularly clear and the type and paper most attractive, while as a sample of ornamental and suggestive binding it is especially to be noticed.

SCIENTIFIC AMERICAN BUILDING EDITION.

JANUARY, 1895.—(No. 111.)

TABLE OF CONTENTS.

1. An elegant plate in colors, showing a Colonial cottage at Williamsbridge, N. Y., recently erected for Chas. H. Love, Esq. Two perspective elevations and floor plans. Cost complete $4,250. Mr. Arthur C. Longyear, architect, New York City. A pleasing design.
2. A Colonial residence at New Rochelle, N. Y., recently erected for J. O. Noakes, Esq., at Iselin's Park. Two perspective elevations and floor plans. Cost $5,000 complete. Mr. Manly N. Cutter, architect, New York City. An attractive design.
3. Colonial residence at Montclair, N. J., recently erected for Sylvester Post, Esq. Two perspective elevations and floor plans. Messrs. W. S. Knowles & A. H. Thorp, architects, New York City. A pleasing design.
4. A seaside cottage recently erected for C. H. Manning, Esq., at Kennebunkport, Me. Two perspective elevations and floor plans. A picturesque and unique design after the "New England" lean-to roof order. Mr. H. P. Clark, architect, Boston, Mass.
5. A residence at East Orange, N. J., erected at a cost of $7,000. Architect Mr. W. F. Bower, Newark, N. J. Perspective elevation and floor plans.
6. The First Presbyterian Church at Stamford, Conn. Two perspective elevations and ground plan. A design of great architectural beauty, treated in the Romanesque style. Mr. J. C. Cady, architect, New York.
7. A residence at Scranton, Pa., erected for E. B. Sturges, Esq., at a cost of $5,000 complete. Architect Mr. E. G. W. Dietrich, New York City. Perspective elevation and floor plans.
8. A summer residence at Cushing's Island, Me., recently erected at a cost of $3,100 complete. Two perspective elevations and floor plans, also an interior view. Mr. John C. Stevens, architect, Portland, Me. An excellent example for a summer home.
9. View of the Armory of the Seventy-first Regiment, New York City. Architect Mr. J. R. Thomas, New York City.
10. Perspective view and floor plans of the fourteen story Reliance Building, Chicago.
11. Miscellaneous contents.—Buff brick popular.—Ceiling and cornice tinting.—Home ground arrangement of plants, illustrated.—Stone dressing by compressed air, illustrated.—Brick dust mortar.—Interesting ruin of cliff dwellers.—Removing the front wall of a warehouse, with sketches.—Improved woodworking machine, illustrated.—Buff brick in New York.—Ceiling paper.—"Dec-co-re-o," a new material for decorative purposes, illustrated.—Improved gutter hangers, illustrated.—Draughtsman's supplies, illustrated.

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Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information and not for publication.
References to former articles or answers should give date of paper and page or number of question.
Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.
Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.
Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.
Scientific American Supplements referred to may be had at the office. Price 10 cents each.
Books referred to promptly supplied on receipt of price.
Minerals sent for examination should be distinctly marked or labeled.

(6349) S. W. asks: 1. Having given 6 inches as length of coil and 1½ inch as diameter of iron core, how many ampere turns are required to magnetize the said core to saturation, and how great (approximately) would be the lifting power of the electro magnet so formed? A. Owing to leakage and to the fact that there is no real saturation point, no exact answer can be given. A very large number of ampere turns can be given with increase of the magnetic power on account of the long air path. 2. If I place two electro magnets end to end with poles near together, is the combined attractive power increased, i. e., will the magnets each pull more than they would acting separately on armatures? A. The combined power will be the same if similar poles face the same way.

(6350) T. H. B. writes: 1. Are all points of the earth's surface at the same potential (electrically)? I have heard it said that, owing to presence of certain minerals, metals, or acids in certain combinations, the potential might be higher at one place than at another, and that, owing to this difference of potential, a current might flow in a telegraph wire joining these two places, sufficiently strong to operate instruments in circuit, even when all batteries were removed from the wire. (The line of course being grounded at the terminals.) I have heard that this experiment has been successfully tried on certain lines removed from any sources of induction. Is the current present in the wire due to conditions stated, or is it due to other sources, and is not such a current, if it exist, properly called an earth current? A. Earth currents so called act as described. Their cause is obscure, but they are due to chemical changes. Telegraphic messages have been transmitted by them. 2. What becomes of the energy of a coiled spring when dissolved (under tension) in acid? I have seen the answer to this question in an earlier copy of the SCIENTIFIC AMERICAN, but cannot recall it. A. The so-called energy is simply the capacity to convert heat into mechanical energy. If a spring does work, its temperature falls. By solution in an acid this capacity is destroyed; there is no destruction of energy

(6351) H. C. R. writes: 1. Do you consider a plastered ceiling safe that has been saturated with water during a cyclone; and then again soaked before the roof could be repaired? A. No; not safe. 2. Would not the vibrations of a powerful church organ tend to bring down such a ceiling? A. Yes. 3. Can such a ceiling be thoroughly examined by simply inspecting the keys from above? A. No. 4. Is it not possible for the keys to appear all right, while the plastering has given way below? A. Yes.

(6352) R. W. K. asks: In designing a generator, is it necessary that there should be from five to seven times the weight of iron in the field as in the armature? Is it necessary that the spaces between the pole pieces should be five times the air gap? A. The factors given merely represent good general practice; there is nothing absolute about them.

(6353) A. T. asks if following dimensions and windings of dynamo will generate 30 amperes with a potential of 52 volts at the brushes: Length of wrought iron field magnets 8½ inches by 5 inches diameter, wound with 28 pounds of No. 18 double cotton covered wire, 10 layers, 140 turns on each leg of magnet. Armature 4¼ inches diameter, 6 inches long, best laminated iron core, wound with No. 12 double cotton covered wire, 32 coils, 4 convolutions in each coil, speed about 1,800 revolutions per minute, general shape of dynamo about same as 60 light dynamo in SUPPLEMENT, No. 865. A. If you succeed in getting the above results, you will do well. If shunt wound, the product of your armature and field resistance should equal the square of the external resistance, or say three ohms.

(6354) J. P. G. asks: In making a Gramme size 3½ inch diameter armature of 12 sections, is it absolutely necessary to wind each section in even layers and convolutions if wires on each section are of equal length? A. To secure a uniform current there should be an equal number of turns of wire in each section; the length is not necessarily identical.

(6355) A. B. says: I take the liberty to offer a suggestion to your answer to F. G. C.'s query, No. 6329, in SCIENTIFIC AMERICAN of December 22, for telling the points of the compass by the aid of the sun and a watch. If the hour hand of the watch be pointed at the sun—the watch lying flat—half way between the hour hand and twelve on the dial will be south. After south is located the other points are easily determined. Doubtless a compass would be more correct, but the method given will be found correct enough for ordinary requirements.

(6356) S. R. H. writes: I have a few questions that I would be glad to have answered in SCIENTIFIC AMERICAN. How far could a person live below the surface of the earth, say for instance 1, 2, or 3 miles deep? Would the air become too dense or compact for them? Is it not a fact that the earth's surface acts as a medium line for the center of gravity, atmospheric and water pressure? How far above the earth's surface is the air considered to be pure and healthy, to contain no poison matter? A. The depth at which a person can live below the surface of the earth depends upon the condition of temperature and the constitutional ability of the person to bear heat. The internal heat of the earth increases 1° Fah. for every 50 to 70 feet of vertical depth in various regions, so that from 2,000 to 3,000 feet in depth is about the limit that a man can work. In parts of the earth which have been subject to volcanic action, as in some of the mining districts, the temperature rises somewat more than 1° in 50 feet, and 120° is the temperature at about 1,500 feet in depth. At this temperature labor is very difficult and forced ventilation has to be resorted to, and by this resource a depth of 4,000 feet may be attained in the undisturbed strata of the earth. The earth's surface is the plane of demarkation for atmospheric and water pressure. The barometer indicates decreased pressure as we go down in mines, the same as in ascending in the air. Water also increases in pressure as the distance beneath the sea. The atmosphere has no known difference in composition at the greatest heights observed. It is its lightness or rarity that affects the lungs at great heights.

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INDEX OF INVENTIONS

For which Letters Patent of the United States were Granted

January 8, 1895,

AND EACH BEARING THAT DATE.

[See note at end of list about copies of these patents.]

Abacus, L. D. Myers 532,282
Advertising board, H. D. Streator 532,111
Aging or treating spirits, R. C. Scott 532,399
Alarm. See Burglar alarm. Low pressure alarm.
Amalgamator, A. Tanner 532,114
Anchor, E. Rettig 532,184
Animal trap, P. H. Sisson 532,343
Annealing box, W. H. Bailey 532,134
Antimony, double salts of O. O. B. Froelich 532,150
Applicator, S. J. Bradley 532,359
Automatic sprinkler or fire extinguisher, W. Esty, 532,269, 532,270
Axle straightening and setting machine, G. L. Collis 532,030
Band, clasping, T. W. Jones 532,070
Barrel leveling and trussing machine, D. A. Gordon 532,322
Basket or carrier for bottles or other articles, H. M. Kolb 532,324
Bath apparatus, portable shower, W. E. Dobbins 532,267
Battery. See Storage battery.
Belt tightener, R. M. Whitney 532,255
Bench hook, A. McFarland 532,387
Bicycle, W. C. Dailey 532,143
Bicycle support, A. M. Ribbany 532,287
Blacking box holder, A. L. Higgins 532,375
Blacking casing, L. Nearing 532,283
Blowing engine or compressor, W. E. Good 532,051
Board. See Advertising board.
Boiler. See Hot water boiler. Pipe boiler. Wash boiler.
Boiler brace, P. McGregor 532,388
Books, device for handling, Pfund & Jacobi 532,425
Boomerang, F. G. Faxon 532,233
Boot or shoe sole or heel paring machine, C. H. & R. H. Southall 532,170
Boot or shoe soles, cutter for trimming, J. J. Mabray 532,171
Boots, machine for finishing wool, C. H. Woodbury 532,352
Bottle filling apparatus, A. Grap 532,235
Bottle necks, tool for forming, F. Achtenhagen 532,191
Bottles, tool for forming flaring lips on, G. L. Jenkins 532,378
Box fastener, W. H. Howe 532,067
Brace. See Boiler brace. Folding brace.
Braided moulds, method of and device for finishing coverings of, F. Markgraf 532,280
Brake. See Carriage brake. Hoisting apparatus brake. Pneumatic brake.
Brake, J. Gardner 532,048
Brick drier, W. T. Nicholls 532,178
Brick kiln, C. J. Holman 532,154
Brick machine, Rolfe & Johnson 532,186
Brick or tile cutting machine, J. Thompson 532,222
Brick truck, A. T. Bemis 532,356
Brush mould, W. Morrison 532,210
Brush, wire, J. F. Bigelow 532,259
Buckle, W. F. Sweet 532,433
Buckle, suspender, J. Kennedy 532,381
Burglar alarm, electric, Scholes & Myers 532,291
Burner. See Hydrocarbon burner. Oil burner.
Burner for use of crude petroleum, etc., Foster & Hammel 532,271
Bust developer, G. C. Hardesty 532,236
Button, collar, F. C. Craw 532,229
Button, separable, F. S. Nelson 532,284
Caisson for erecting bridge piers, Chechong & Balensiefer 532,140
Calculator, Loomis & Phillips 532,383
Camera diaphragm, M. Levy 532,326
Car bolster, H. R. Stanford 532,107
Car coupling, Downey & Hummer 532,315
Car coupling, J. E. Forsyth 532,045
Car coupling, C. Frost 532,272
Car coupling, J. W. Hayward 532,059
Car coupling, C. Heise 532,323
Car coupling, E. C. Inderlied 532,275
Car coupling, W. McNames 532,087
Car coupling, H. Rienow 532,337
Car coupling, Russell & Perry 532,102
Car draught attachment, railway, J. Timms 532,115
Car fender, J. E. McBride 532,086
Car fender and brake, railway, J. T. Matthews 532,385
Car guard, street, W. H. Paugh 532,393
Car platform life-saving apparatus, street, W. H. Rodgers 532,339
Car safety attachment, R. Bustin 532,360
Car wheel and axle, mine, I. Barker 532,017
Cars, motor suspension for electric street, S. Harris 532,057
Carboy holder, J. O. Rathbun 532,094
Card grinding machine, C. Mills 532,331
Carriage brake, Brown & Welch 532,137
Carriage provided with heating apparatus for transporting food, etc., J. Lay 532,325
Case. See Egg case. Shipping case. Show case.
Cash register, W. G. Latimer 532,423
Casks, drums, etc., securing heads of, G. Powell 532,248
Cereal reducing machines, receiving trough and cutter for, H. D. Perky 532,286
Check row wire, mechanism for reeling, W. E. Surface 532,112
Chimney lifter, F. Rhind 532,336
Clamp. See Trolley wire clamp.
Clay shingles, die or mould for making, Murray & Welch 532,085
Clippers, gauge or guard plate for hair, J. K. Priest 532,335
Clipping machine, electric hair, P. Shannon 532,188
Clock level, W. J. Marshall 532,078
Clothes line reel, Woodward & Geisler 532,130
Clothes to clothes lines, device for attaching, O. McShane 532,242
Clutch, Akerley & Horton 532,258
Clutch, friction, W. H. Lindsay 532,162
Coal separator, J. R. Richardson 532,427
Coffee roaster, D. H. Marshall 532,207
Coffin handle, detachable, J. Klar 532,073
Collar fastener, horse, P. H. Dubois 532,039
Combination wrench, G. W. Dunsworth 532,041
Combing machine attachment, wool, Smith & De Vries 532,217
Computing machine, R. E. McClelland 532,241
Conductor, M. D. Law 532,161
Conductor support, J. C. Love 532,164
Cooker, steam feed, C. Wood 532,131
Cooking vessel, C. Baumgardner 532,226
Coop, etc., folding, T. A. Allen 532,303
Coop for poultry, shipping, M. L. Reeves 532,212
Copy holder, C. Spiro 532,346
Copying bath, capillary, Thorp & Gifford 532,404
Cotton press, S. D. Murray 532,386
Coupling. See Car coupling. Thill coupling.
Cultivator, R. S. Chaney 532,313
Cultivator, B. F. Harford 532,056
Curling iron, O. G. Dunnom 532,317
Curling iron, Howard & Hellstrom 532,066
Curtain stretcher, W. A. Cochran 532,416
Curtain stretcher, C. Linder 532,382
Cutter. See Potato cutter.
Displaying reading matter, device for, H. B. Butts 532,024
Distilling and sterilizing water, apparatus for, J. Nagel 532,390
Ditching machine, H. M. & A. J. Fuller 532,369
Door, E. Hines 532,201
Door, flexible, E. Brown 532,021
Door holder, H. Fletcher 532,367
Door stop, L. Funk 532,151
Draught equalizer, Smith & Barto 532,345
Drawing and evening sliver, machine for, W. V. Threlfall 532,405
Drier. See Brick drier. Portable drier.
Drying kiln, W. G. Galloway 532,418
Drill. See Hand drill.
Duplicating apparatus, A. D. Klaber 532,205
Dust collecting system, H. L. Day 532,144
Dust separator, McNaughton & Seymour 532,389
Dye, blue disazo, A. Weinberg 532,125
Easel, desk, R. M. Hitch 532,063
Eaves trough, W. S. Harris 532,056
Egg case, W. A. Humfeld 532,156
Electric conductor tension device, J. C. Love 532,166
Electric wires, crossarm for support of, E. J. Bullock 532,260
Elevator and dump, R. Bullis 532,022
Elevator guide post clamping device, M. Christopherson 532,414
Elevator safety device, S. P. Kay 532,158
Ellipsograph, J. Hottinger 532,155
End gates, locking device for wagon, J. T. Duncan 532,040
Engine. See Blowing engine. Gas engine. Gas, oil or vapor engine. Gas or petroleum engine. Hydrocarbon engine. Rotary engine. Steam engine.
Engine attachment, steam, M. H. Molloy 532,083
Entrails, machine for cutting and cleaning, Reyels & Ebert (r) 11,463
Envelope, A. D. Klaber 532,206
Escutcheon, C. R. Uhlmann 532,223
Fastening and driving tool therefor, metallic, J. J. A. Guibaud 532,052
Feedwater purifier, J. Mohr 532,082
Fence, L. M. Shirtcliff 532,292
Fence machine, wire weaving, E. S. Morgan 532,240
Fence post, Pitney & Gardner 532,246
Fermenting vat, C. Hauger 532,373
File cutting machine, A. Weed 532,123
Firearm, gas-operated, C. Johnson 532,380
Fire escape, J. J. Haller 532,054
Fire extinguisher, automatic, W. Esty 532,268
Fireproof ceiling, C. F. W. Doehring 532,037
Fireproof wall, C. F. W. Doehring 532,038
Fluid under pressure, means for transmitting, W. S. Halsey 532,198
Folding brace, I. O. Harsh 532,058
Furnace. See Hot water furnace. Siphon furnace.
Furnace, U. P. Smith 532,218
Furnace air distributer, Burnshire & Click 532,309
Furniture, adjustable support for school, T. R. Roulstone 532,396
Game apparatus, C. W. Zaremba 532,132
Garment supporter, G. D. Nichols 532,244
Garment supporter, C. W. Stimson 532,402
Gas, apparatus for making and purifying, R. H. Laird 532,075
Gas burners, automatic safety attachment for, H. H. Cummings 532,142
Gas engine, J. A. Charter 532,314
Gas, oil, or vapor engine, J. Robison 532,098
Gas or petroleum engine, P. Bilbault 532,412
Gas or vapor and air mixing and spraying device, J. Robison 532,099
Gear cutting machine, L. E. Whiton 532,127
Generator. See Steam generator.
Glove holder, S. Free 532,319
Grain cleaning and separating machine, C. Closz 532,415
Grate raking and cleaning attachment, J. G. Ernst et al 532,194
Grave implement, S. Todd 532,116
Grinder, knife, C. Seybold 532,104
Guard. See Car guard. Railway cattle guard. Window guard.
Guns, cocking mechanism for breakdown, H. Park 532,090
Guns, ejecting mechanism for breakdown, J. Rider 532,096
Hame, W. Fischer 532,318
Hame fastener, W. H. Johnson 532,422
Hammock, G. B. French 532,047
Hand drill, J. Defatsch 532,145
Harrow, J. B. Morrison 532,332
Harrow and seeder, combined, S. H. Raymond 532,426
Harvester, corn, J. J. Osburn 532,392
Harvester reel, J. H. Fulton 532,320
Hat and clothes book, Stinchcomb & Danner 532,109
Hat sweats, device for attaching reeds and flanging, C. G. Ives 532,276
Hay press, H. O. Hem 532,060
Hay rake, A. E. Mattwich 532,079
Heater. See Hot water heater. Lamp heater. Steam or hot water heater.
Heater, H. Gutschmidt 532,273
Heel and sole for boots, etc., elastic or anticoncussion, L. Rogers 532,429
Hinge, adjustable, J. K. Fagan 532,044
Hoisting apparatus brake, A. Bolzani 532,227
Hook. See Bench hook. Hat and clothes hook. Transfer hook. Whiffletree hook.
Hook and eye, S. I. Slade 532,401
Horses, undercheck for, J. R. Buchanan 532,308
Hose carriage, B. L. Stowe 532,432
Hose rack, B. L. Stowe 532,403, 532,431
Hot water boiler, A. Burt 532,139
Hot water furnace, W. C. Johnson 532,069

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Hot water heater, J. H. Wynne ... 532,256
House construction, school, A. C. Watson ... 532,253
Hydrocarbon burner, W. R. Jenkins ... 532,202
Hydrocarbon engine, C. & A. Spiel ... 532,219
Incubator, A. Kerr ... 532,278
Indicator. See Office indicator.
Injector, B. M. Throop ... 532,297
Ink well, E. Stern ... 532,347
Ink well, J. Werner ... 532,299
Insulated pipe joint, M. J. Locke ... 532,328
Insulator, M. D. Law ... 532,160
Insulator, electric wire, D. M. Rothenberger ... 532,101
Iron. See Curling iron.
Iron or steel articles, process of and apparatus for pickling, W. S. Rawson ... 532,394
Jack. See Lifting jack.
Joint. See Insulated pipe joint. Rail joint. Railway rail joint.
Kiln. See Brick kiln. Drying kiln.
Knitting machine striping attachment, M. A. J. Keane ... 532,203
Lacing hooks, die for applying plastic material to, E. Kempshall ... 532,204
Lamp burner, C. M. Lungren ... 532,077
Lamp, electric arc, A. W. Richardson ... 532,095
Lamp heater, A. L. Robbins ... 532,215
Lamp support, electric, Nortney & Schefold ... 532,391
Lamp support, electric, Schefold & Nortney ... 532,103
Lantern, C. D. Seys ... 532,400
Lawn sprinkler, J. H. Melavin ... 532,281
Lifter. See Transom lifter.
Lifting jack, lever, Weiler & Stutsman ... 532,124
Lightning arrester, A. Wurts ... 532,353
Lightning arrester, A. J. Wurts ... 532,354
Lock. See Sash lock.
Loom let-off and take-up mechanism, F. G. Chambers ... 532,312
Loom let-off and take-up mechanism, C. B. Rumsey ... 532,341
Loom reed, C. B. Rumsey ... 532,340
Loom shedding mechanism, H. Wyman ... 532,225
Low pressure alarm, B. C. Whelan ... 532,224
Lubricator, S. Davies ... 532,231
Machine wrench, W. B. West ... 532,350
Marking points and erasing material, holder for, Petterson & Dudly ... 532,245
Measuring instrument, lens, A. H. Biegel ... 532,135
Measuring vessel, W. H. Kister ... 532,072
Message register, W. M. Wade ... 532,121
Metal articles from dies, apparatus for removing stamped, J. M. Van Fleet ... 532,434
Metals, process of and apparatus for separation of, B. Moebius ... 532,209
Middlings purifier, P. H. Jacobus ... 532,068
Mill. See Stamp mill.
Moulding machine, W. F. Richards ... 532,213, 532,214
Mopping machine, L. H. Brightman ... 532,020
Mortising machine, Doane & Sofge ... 532,035
Mower attachment, lawn, C. W. Wheeler ... 532,300
Mower bar lifting attachment, G. R. Parker, 532,091, 532,092
Mower clover seed attachment, D. Crough ... 532,360
Mower, lawn, T. & W. H. Coldwell ... 532,233
Mowing machine, A. Stevens ... 532,430
Musical instrument string clamp, Hafer & Love ... 532,053
Musical instruments, note sheet or barrel for mechanical, F. Schaub ... 532,290
Non-conducting covering, E. W. Tucker ... 532,407
Nut lock, H. R. Clark ... 532,027
Nut lock, C. Hahn ... 532,274
Nut lock, T. H. Smith ... 532,169
Office indicator, H. T. Coombs ... 532,362
Oil burner, W. R. Jenkins ... 532,379
Oil burner for lamps or stoves, E. S. Drake ... 532,316
Oiler, automatic crank pin, J. Miller ... 532,208
Ore sweeping and recovering device, C. F. Pike ... 532,183
Ore treating apparatus, N. H. Cone ... 532,263
Ores in river bottoms, device for washing, C. P. Pike ... 532,182
Oven, portable, D. A. Wesley ... 532,408
Padlock, E. T. Fraim ... 532,234
Paint mixing and grinding machine, T. G. Johnson ... 532,277
Paper, machine for applying waterproofing to, C. C. Macbrair ... 532,172
Paper watermaking apparatus, W. K. Trotman ... 532,252
Photographic lens tube diaphragm, M. Levy ... 532,327
Photographic objective, P. Rudolph ... 532,398
Photographs on textile fabrics, printing, R. Martin ... 532,173
Piano, upright, H. Ziegler ... 532,257
Pin. See Safety pin.
Pipe boiler, J. Kaine ... 532,071
Pipe cleaner, waste, F. H. Hoyt ... 532,376
Pipe cover, N. Rubenstein ... 532,187
Placket fastener, J. Plutzer ... 532,247
Plaiter, J. C. Hedges ... 532,199
Planter attachment, W. L. Stickles ... 532,295
Platform. See Window platform.
Plow, W. W. Newberry ... 532,383
Pneumatic brake, W. B. Wallace ... 532,298
Pneumatic tool, J. G. Carlinet ... 532,311
Poke, animal, W. J. & A. Harnois ... 532,372
Portable drier, M. A. Overton ... 532,089
Post. See Fence post.
Pot and lid, T. Carabine ... 532,361
Potato cutter, seed, P. Brown ... 532,228
Powder receptacle, C. J. & C. M. Gillette ... 532,049
Power transmitting device, T. W. Heermans ... 532,237
Precious metals from sand, gravel, etc., apparatus for separating, P. P. Cuplin ... 532,266
Precious metals from solutions, precipitating, C. Moldenhauer ... 532,238
Press. See Cotton press. Hay press. Printing press.
Printing machine, G. R. Clarke ... 532,193
Printing press, multicolor, H. R. Corkill, Jr ... 532,417
Printing press, multiple, W. C. Chamberlain ... 532,026
Puller. See Spike puller.
Pulley, automatic gripping cable, J. H. Watts ... 532,349
Pulley shields, apparatus for draining submerged, J. P. Collins ... 532,028
Pulverizing machine, M. B. McLauthlin ... 532,177
Pump, R. S. Chaffee ... 532,025
Pump, J. Pfender ... 532,180
Punch, portable hydraulic, E. B. Cornell ... 532,265
Pycnometer support and dam, W. C. Van Vliet ... 532,120
Rack. See Hose rack.
Rail, C. Sill ... 532,293
Rail joint, A. Gudmunsen ... 532,197
Railway cattle guard, E. Cook ... 532,264
Railway, conduit electric, A. M. Burgher ... 532,261
Railway conduit, electric, J. C. Love ... 532,165
Railway converter system, electric, G. W. Swartz ... 532,113
Railway danger signal, D. A. Gordon ... 532,152
Railway rail joint, Hoffmann & Friedlaender ... 532,421
Railway rail tie and fastening, E. C. Davis ... 532,364
Railway rails, conductor bond for meeting ends of electric, P. Rieth ... 532,185
Railway rails, etc., rolls for reducing, F. P. Maus ... 532,424
Railway signal, J. Wayland ... 532,122
Railway supply system, electric, A. G. Wheeler ... 532,126
Railway switch, R. T. Gilliam ... 532 050
Railway trolley, electric, J. C. Henry ... 532,200
Railway trolley, electric, J. C. Love ... 532,167
Railways, closed conduit for electric, F. Windle ... 532,302
Railways, safety device for inclined plane, P. A. Deane ... 532,033
Rake. See Hay rake.
Reel. See Clothes line reel. Wire rod reel.
Refrigerator weighing and registering attachment, W. B. Dickson ... 532,034
Register. See Cash register. Message register.
Roaster. See Coffee roaster.
Roller mill feeder, J. B. Cornwall ... 532,141
Rope machine, G. L. Brownell ... 532,307
Rotary engine, H. A. House ... 532,065
Rotary engine, W. O. O'Brien ... 532,179
Saddle, J. A. Metcalf ... 532,081
Saddle, riding, J. B. Haines, Jr ... 532,419
Safety pin, G. D. Nichols ... 532,243
Salt trough, C. M. Arthur ... 532,015
Sand box spout, J. Hirth ... 532,420
Sanding machine, traverse, Taylor & Clough, Jr ... 532,348
Sash fastener, J. J. Hinkle ... 532,062
Sash lock, P. S. Riddelle ... 532,395
Saw, G. E. Boostrom ... 532,357
Saw set, C. Morrill ... 532,175
Saw tooth, M. H. Goulding ... 532,371
Scale beam computing attachment, E. W. Wise ... 532,129
Scale recording attachment, F. B. Finley ... 532,147
Scraper or excavator, M. Collins ... 532,029
Screw machine, C. M. Spencer ... 532,106
Separator. See Coal separator. Dust separator. Steam and water separator.
Sewing machine, E. H. Smith ... 532,344
Sewing machine table or cabinet, T. Kundtz ... 532,074
Shaking, settling, and compacting machine, J. Baldwin, Jr ... 532,304
Sheet metal, stamping or drawing, F. C. Bellinger ... 532,355
Shipping case and cabinet, C. Madson ... 532,279
Ships and water, means for reducing friction between, J. Thomas ... 532,220, 532,221
Show case, F. Pollard ... 532,093
Sign, J. A. Dalumi ... 532,032
Sign, illuminated street car, J. M. Allison ... 532,411
Signal. See Railway signal. Railway danger signal.
Singletree attachment, R. T. Van Valkenburg ... 532,119
Siphon furnace, Sieben & Wagner ... 532,105
Smoke consumer, G. Fox ... 532,046
Spectacle case holder, R. T. Roberts ... 532,288
Sphere, armillary, S. M. Gibbs ... 532,370
Spike puller, P. Fowler ... 532,149
Spindles, device for tightening loose, P. S. Snyder ... 532,190
Spinning rings, manufacturing, M. D. Marcy ... 532,174
Splice, A. Davy ... 532,365
Sprinkler. See Lawn sprinkler.
Stamp, hand, J. Hoop ... 532,064
Stamp mill, H. Burson ... 532,023
Stapling machine, W. J. Brown ... 532,136, 532,138
Steam and water separator, J. E. Sweet ... 532,296
Steam engine, W. D. Sherman ... 532,250
Steam generator, E. H. Moorman ... 532,084
Steam or hot water heater, D. L. Adams ... 532,014
Still, water, Jackson & Fitzgerald ... 532,377
Stocking, P. Glouton ... 532,196
Stone breaker, G. Lowry ... 532,329
Stones, making paving, A. Typlt ... 532,118
Storage battery, T. A. Willard ... 532,128
Stove, cooking, S. Boal (r) ... 11,462
Stovepipe retaining device, E. G. Lufkin ... 532,384
Street sweeper, H. Mueller, jr ... 532,176
Surgical needle holder, L. R. Brown ... 532,306
Switch. See Railway switch.
Table. See Transfer table.
Tags to articles, instrument for wiring, W. Young ... 532,409
Tap and reamer wrench, E. J. Nichols ... 532,285
Teaching embroidery or kindred arts to the blind, M. F. C. Stockmann ... 532,110
Thill coupling, L. Rawdon ... 532,249
Thrashing machine and stacker attachment therefor, F. W. Robinson ... 532,428
Ticket, railway, W. H. Campbell ... 532,310
Tire, wheel, T. B. Sloper ... 532,189
Tool handle fastening, D. L. & S. C. Dunlap ... 532,366
Tramway, conduit, J. C. Love ... 532,163
Transfer hook, P. W. Gates ... 532,321
Transfer table, M. Rounds ... 532,397
Transom lifter, E. S. Merrill ... 532,080
Trap. See Animal trap.
Triturator, A. J. Weatherhead ... 532,254
Trolley arm, underground, P. C. Just ... 532,157
Trolley, self-adjusting, J. Corcoran ... 532,631
Trolley support, L. T. Gibbs ... 532,195
Trolley wire clamp, J. C. Love ... 532,168
Trolley wire clip, J. M. Andersen ... 532,133
Trombone, slide, S. Stephens ... 532,108
Trough. See Eaves trough. Salt trough.
Trousers stretcher, K. S. O'Keeffe ... 532,334
Trunk, W. F. Miller ... 532,330
Trunk fastener, F. J. Eichbauer ... 532,042
Tube cleaner cutting roller, W. F. Bradbury ... 532,358
Turbine wheel, steam or gas, C. G. P. De Laval ... 532,232
Type casting and setting machine, J. C. Fowler ... 532,368
Typewriter key cushion, Graham & Savell ... 532,153
Typewriting machine, C. K. Nichols ... 532,211
Vapor generators, initial heater for, L. Flory ... 532,148
Vaporizer, retort, J. O. Beazley ... 532,018
Vaporizing and ignition device, J. Robison, 532,097, 532,100
Vat. See Fermenting vat.
Vehicle, electrically propelled, Baker & Elberg ... 532,016
Vehicle running gear, W. A. Sayers ... 532,342
Vehicle wheel, G. Laube ... 532,076
Velocipede multiple speed gearing, F. Bower ... 532,305
Wagon, W. O. Shadbolt ... 532,216
Wagon, coal, Sagle & Taylor ... 532,289
Wagon, dumping, A. Widmayer ... 532,301
Warp threads, apparatus for drying, G. R. Burns ... 532,262
Wash boiler, A. V. Trust ... 532,117
Water heating and filtering apparatus, J. G. Hermes ... 532,374
Weighing and package filling machine, automatic, Dobie & Dewson, Jr ... 532,036
Well machinery, oil, C. F. Rigby ... 532,338
Wheel. See Car wheel. Turbine wheel. Vehicle wheel.
Wheel, F. Klingelhofer ... 532,159
Whiffletree, L. D. Brown ... 532,413
Whiffletree, Sholl & Schneider ... 532,251
Whiffletree hook, H. P. Egedal ... 532,146
Whiffletree hook, C. W. Phelps ... 532,181
Whistle, steam, F. W. Ofeldt ... 532,088
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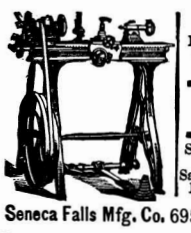

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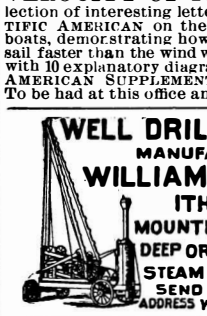

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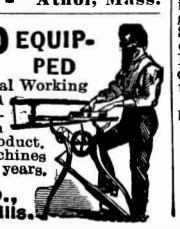

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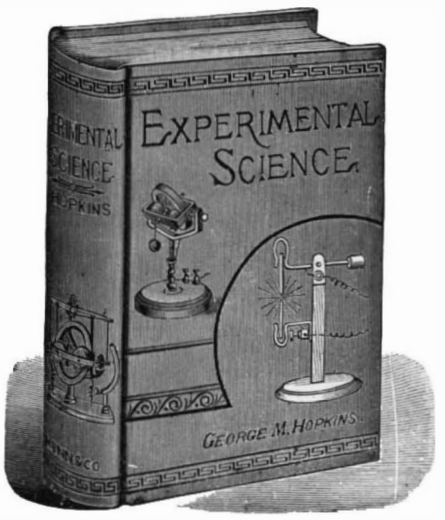

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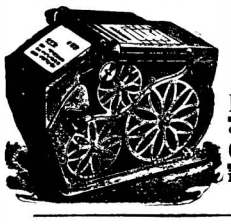

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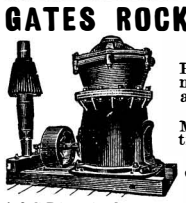

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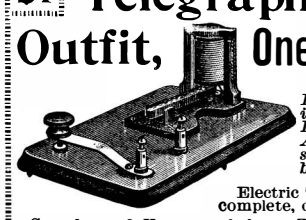

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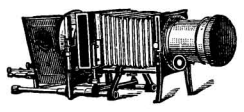

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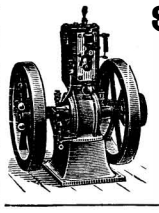

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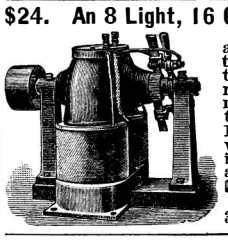

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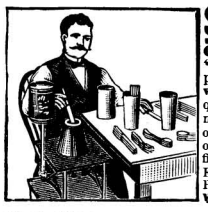

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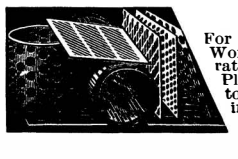

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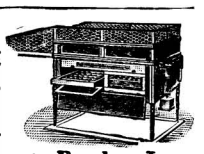

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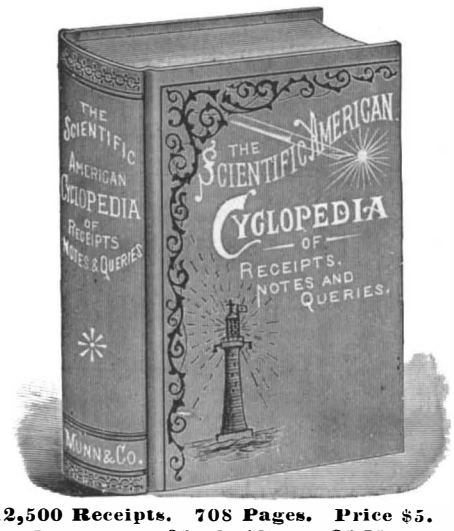

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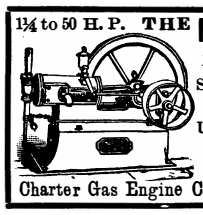

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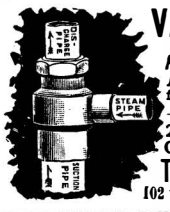

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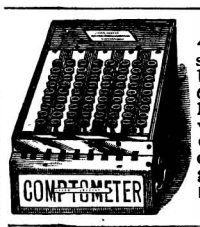

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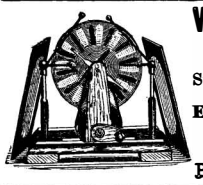

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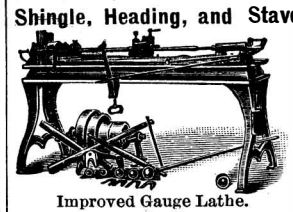

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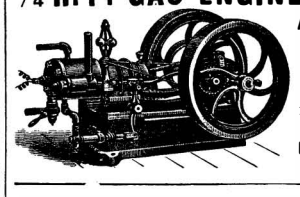

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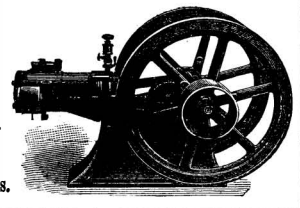

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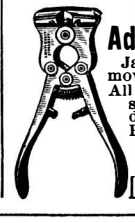

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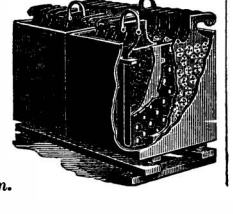

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